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TRAINING PUPILS TO STUDY

By

H. B. WILSON

Superintendent of Schools, Topeka, Kansas

Baltimore
WARWICK & YORK, Inc.
1917

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This monograph was issued in the course of study series of the Topeka, Kansas, Public Schools, in January, 1917, as a supervisory device. The object was to supply help to the teaching staff in their efforts to train pupils in effective methods of study and work. Accordingly, the aim was to record in an organized statement the different things which teachers reported they did in training their pupils to study. Largely because Dr. A. E. Winship commented favorably in the JOURNAL OF EDUCATION upon the value of the monograph, the official edition of the document was exhausted by March first. The requests for it continued, however, in such large numbers as to justify a reprinting of the work, practically without revision, in book form.

The text is divided into two sections. The first section is an analytical presentation in outline form of the results obtained from grade to grade in different subjects in training the children in the right habits of study. This outline has been built up by dissecting reports presented by the teachers. The second section presents a few complete reports showing what different teachers did in detail in training the children to study.

Training Pupils to Study should have a large field of usefulness in its present form. It is a text that will prove helpful to teachers and students in normal schools, schools of education, and in colleges and universities having departments of education. As a supervisory device it recommends itself to the progressive superintendent, who will find it desirable to procure enough copies to place one on the desk of each teacher as a working manual and guide in the matter of training pupils to study. While courses of study in such subjects as geography, English, history, arithmetic, etc., must be adapted to local conditions, a handbook of this kind, if the superintendent and teachers believe in its point of view and the importance of providing such training, may be used just as well in any other system as in the one with which it was originally developed.

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THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

DISTRIBUTION OF GRADES

J. L. ZERBE

University of Pittsburgh

In April, 1915, a few weeks before the grading of the work of the night students and a month or so before the final grading of the day students of the School of Applied Industries, Carnegie Institute of Technology, the author, with the approval of the Dean, presented a report to the faculty showing the distribution of 28,257 grades, covering the two semesters, 1912–13, 1913–14, the first semester 1914–15 and the grades of all who had graduated from this school. In the letter of transmission to the Dean, which accompanied the report to the faculty, it was stated: "It is thought that this information in the hands of the faculty at this time will insure a more uniform distribution of grades for the final records of this term." The present paper is to indicate the results of this report on the final grading of the work of the second semester.

Space does not permit the publication of the report in its entirety but a summary of facts and the emphasis placed on the matter will be given. In the report the following tabulations were illustrated by graphs.

Total Distribution in Per Cents

Grade	1912–13		1913–14		1st Sem. 1914–15		Graduates		Total	
H[1]	5%		4%		4%		12%		7%	
M	16		17		17		14		16	
C	42		39		44		55		43	
P	14		14		16		16		15	
F	9		9		8		2		8	
D	5	23	4	26	5	19	1	3	4	20
R	6		5		5				4	
Fa	3		8		1				4	

The unsatisfactory grades are bracketed and indicate that a large percentage fail to do satisfactory work and that a great waste of teaching energy must result when so large a percentage of failures is due to absences. The survival of the fittest is shown in the grades assigned the graduates.

A more detailed study suggests a separation of the grades assigned for the day and night courses and is here presented.

	1912–13				1913–14				1st Sem. 1914–15			
	Day		Night		Day		Night		Day		Night	
H	3%		8%		3%		6%		4%		4%	
M	15		14		17		17		16		19	
C	46		35		45		33		46		37	
P	15		12		15		12		17		15	
F	10		9		10		9		9		6	
D	3	21	7	32	3	20	5	32	4	17	6	25
R	4		9		5		4		3		8	
Fa	4		7		2		14		1		5	

The close proximity of the distribution for the day and night courses respectively from year to year indicates that the grading for the day and the night students ought to be based on different standards.

Different standards for the type of work is indicated by a study of the grades assigned for academic work and those for the shop work. Because of the uniformity of distribution from year to year a detailed study was made only of the term 1913–14. The following tabulation shows difference of grading used by academic teachers and shop instructors.

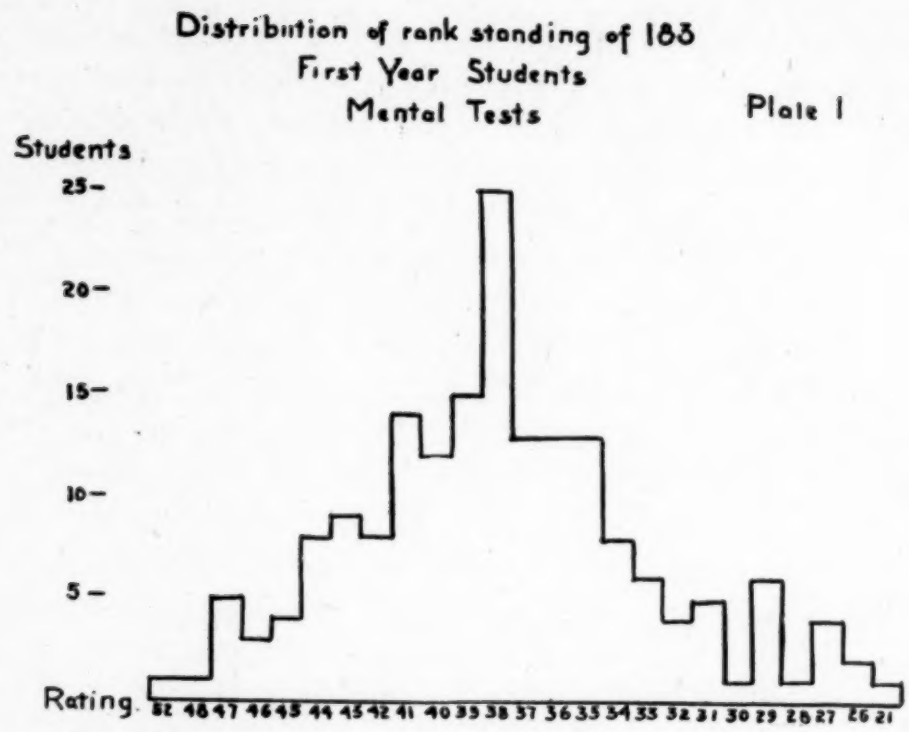
	H		M	CO	P	F	D		R	Fa
Practical or shop course	5		19	49	12	5	6		2	1
Summarizing total		25		49			26			
Theoretical or academic	3		16	30	16	12	5		7	13
Summarizing total		19		30			51			

If fifty-one per cent. of all grades assigned is valued as passing or below, as is indicated for the academic subjects, is it not to be inferred that the standard is too high for the class of students taking the work? The combined judgment of the fifty-five instructors considered in 1913–14, is that twenty-six per cent. of all grades assigned is below passing, while the distribution for the passing grades by the individual instructors ranges from fifty-five to two per cent. of all grades granted by the respective instructors.

From the difference in the distribution of the grades for the practical work from that of the academic subjects, it might be inferred that the students are a specialized group and emphasise

---

[1] The manual of instructions concerning grades and ratings issued by the Carnegie Institute of Technology presents the following valuation for the letters used: Honor (H) 95 to 100 per cent.; Merit (M) 85 to 94 per cent.; Credit (C) 70 to 84 per cent.; Passed (P) 60 to 69 per cent.; Failure (F) 40 to 59 per cent.; Repeat (R) 0 to 39 per cent.; Deferred (D) Work unfinished for reasons satisfactory to the Dean. Failure due to Absence (Fa) is used by some instructors and is not found in the manual.



the motor rather than the mental side of their training; or that they, perhaps, do not represent the average in mental ability. Since the academic curve is skewed toward the failure point it might be further argued that they have not the mentality nor the training to properly pursue the academic subjects. Plate 1 shows a distribution of mental ability as determined by a series of psychological tests given to one hundred eighty-three first year students, whose scholastic grades or class standing has been considered in the above figures. The graph is constructed from the distribution of ability for distracted[2] and undistracted[3] attention, ability to interpret written[4] and oral[5] instructions, immediate memory under distraction,[6] logical memory,[7] association,[8] vocabulary,[9] learning capacity,[10] constructive imagination,[11] judgment,[12] and mental reaction time.[13] These one hundred eighty-

[2] Cancellation test, No. 77261—A (Stoelting's catalogue) Whipple's Manual, while listening to reading.
[3] Cancellation test, No. 77261—B.
[4] Woodworth and Wells Test, No. 88072.
[5] Ability to follow instructions in performing the tests.
[6] Reproduce from memory the passage listened to during Test 1.
[7] Logical memory beginning "Fire at Boston."
[8] Free association, number of words written in three minutes.
[9] Number and quality of words written in Test 7.
[10] Woodworth and Wells substitution test, No. 88042.
[11] Original test of author, to fill in missing lines in geometrical figures.
[12] Estimation of number of dots on card.
[13] Easy opposites No. 77341—C–B.

three students represent, no doubt, the average ability of the entire student body and the results as shown in this curve indicate that their mental ability, as tested, approximates very nearly the curve for the surface of frequency and consequently represents the average distribution of mental activity. If this be so, and if the 183 students are a fair representation of the entire student body, it is evident that the grades as distributed for the shop work are based on a much lower standard than are the grades assigned for the theoretical subjects. Since the academic curve is skewed toward the failure point might it not be inferred that the standard is too high for the average student taking these courses?

A further detailed study leads to a consideration of the assignment for the separate courses. Plate II shows the distribution in per cents for the different courses. It does not however, indicate grades for the separate branches of the courses. Comparing the individual judgments for each subject with the combined judgment of the entire group, it will be noted that few if

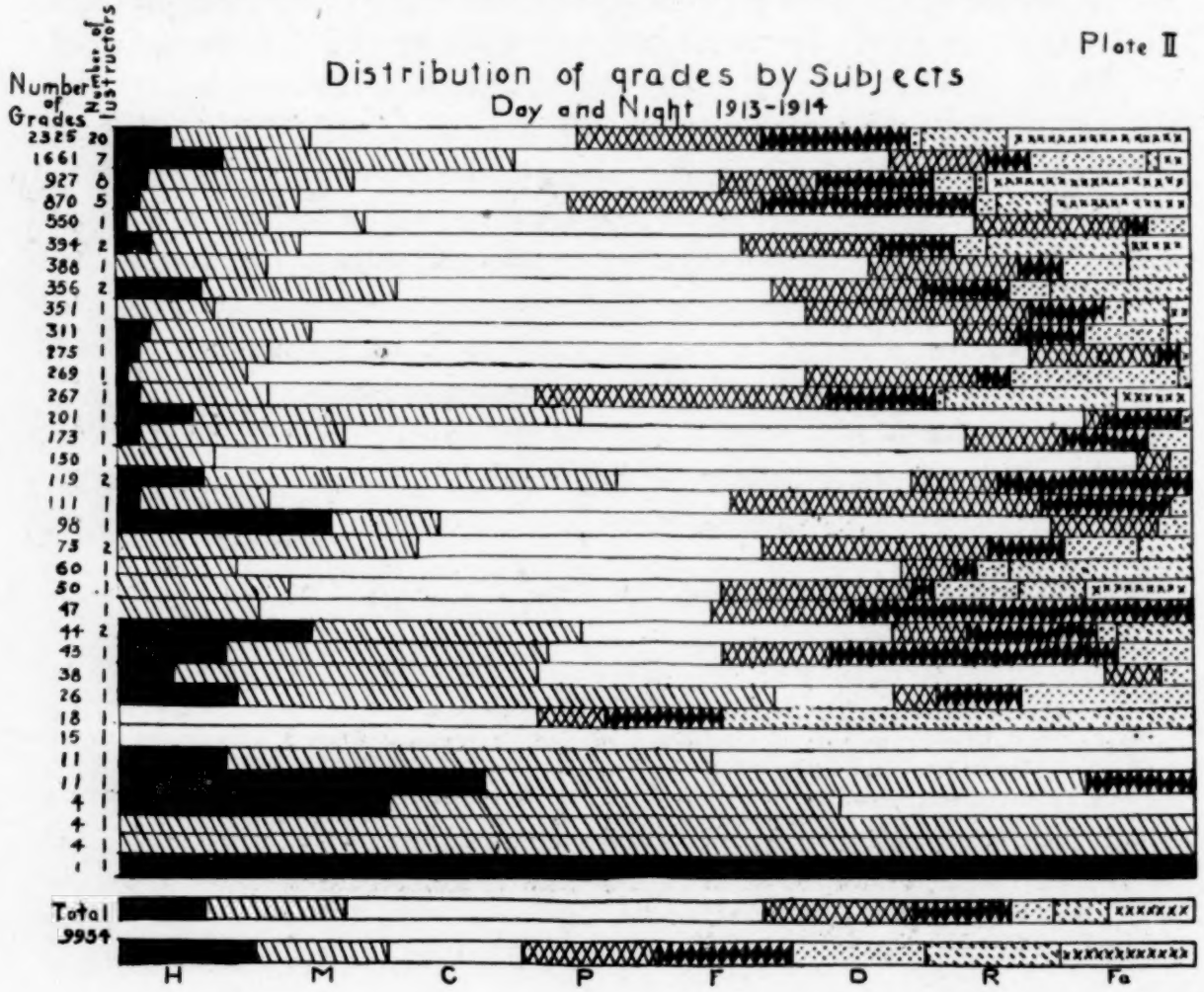
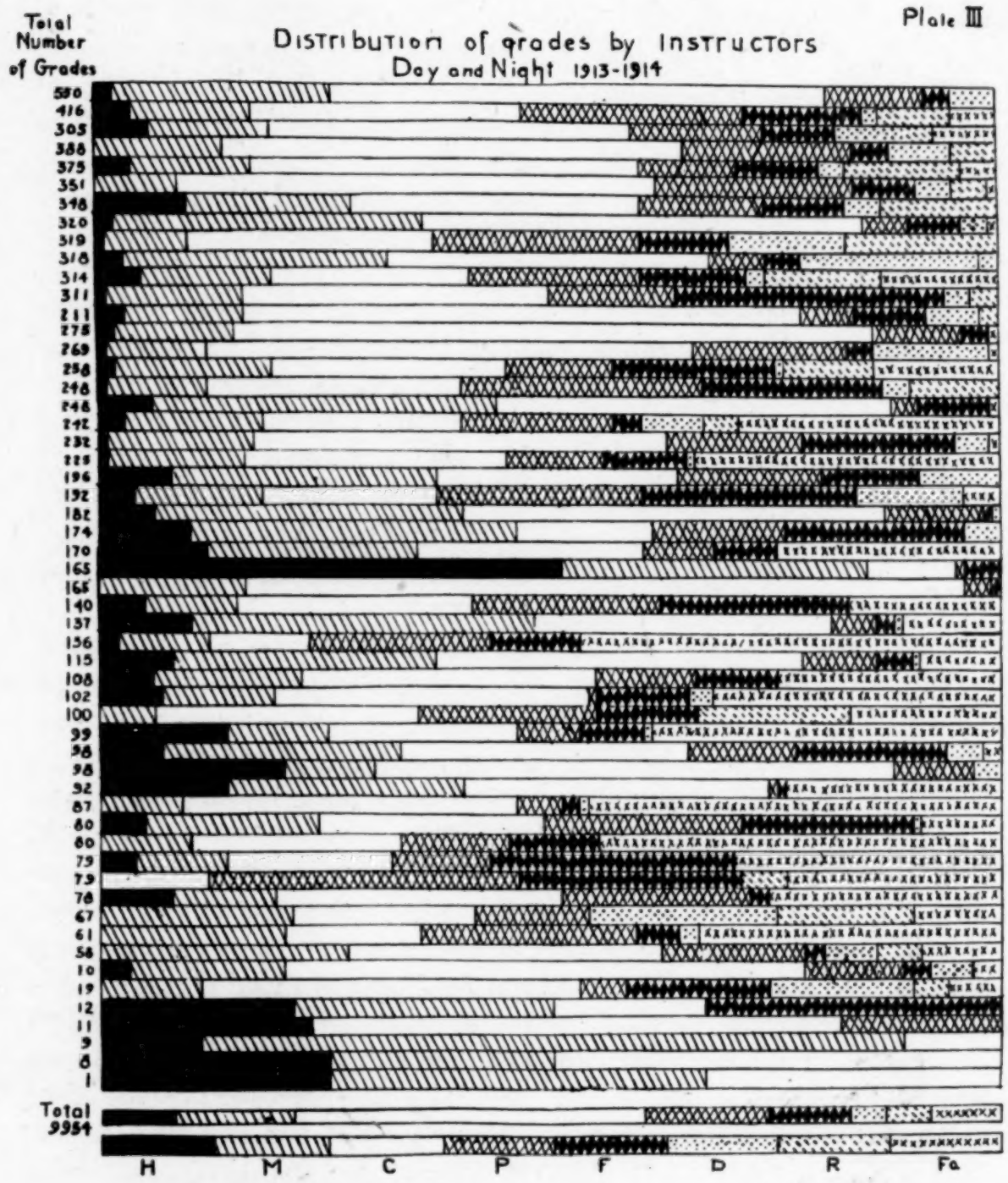


Plate III



any approximate the distribution of the entire faculty. In two very fundamental subjects forty per cent. of all grades given are below passing, while in another subject forty-five per cent. of all grades are below passing. In one academic subject thirty-five per cent. are below passing, while in one of the shop subjects only two per cent. fall below that grade. In another academic subject thirty-six per cent. are failures, while in another shop subject only three per cent. do unsatisfactory work.

Plate III shows the distribution of the grades by the individual instructors. Here the lack of conformity to a standard is especially marked. At the bottom of the plate the distribution of the 9954 grades represents the curve of distribution for the entire faculty. Of the 388 grades given by one instructor not one grade is accorded the value of "H," while another instructor in another subject gave the "H" grade to fifty-one per cent. of the 165 grades he assigned, and the "M" grade to thirty-four. In a different subject another instructor, with no doubt the same students, grants 351 grades, none of which is "H" and only nine per cent. are as high as "M." Of 136 grades given by another instructor fifty-seven per cent. are below passing, while of 165 grades granted by another instructor less than one per cent. is below passing, not one as high as "H" and eighty per cent. are given the grade "C." For 1914–15, this instructor assigned no "H" grades, ninety-three per cent. are "C's" and none is below passing except three per cent. of "D's."

Can such grading be justified on the assumption that the quality of work is different, that some instructors command ability, that the class is more interesting or better prepared, that the subject is more important or fundamental, that the instructor is superior? Or what can be truthfully assumed as the cause of this wide variation? Without some standard, foot-rule, or gauge one reason is just as plausible as another, and just as faulty as any other. The student who receives an "H" from one instructor cannot possibly receive that grade from another who holds his subject so important and his standard so high that no one can be considered perfect enough to merit the highest grade of the school—"Honor." Two of the instructors whose figures are quoted above did not give an "H" grade for the entire term 1912–13 and one of them none for the first term 1914–15. In other words, this instructor has not given an "H" grade in two and one-half years covered by this report. Is it possible that in two and one-half years not one student (who was graded by the large number of grades assigned by this instructor although many of them were honor students) could do work sufficiently well to merit an honor grade in this subject?

President Foster, of Reed College, who has made an exhaustive study of the distribution of grades at Harvard University and other institutions of learning has this to say: "Not only are there

extreme variations among different courses, but there are variations in the same courses from year to year that cannot be accounted for apparently by any of our scientific studies in the distribution of abilities among human beings. . . . From Maine to California the administration of college credits, though alike in no other particular, agree in this . . . that its basis is personal rather than scientific."[14] The instructor who considers that out of 388 grades assigned there are fewer than one per cent. that are equal to the distinction of "H" has a very different conception of the requirements necessary to obtain that distinction from the instructor who places fifty-one per cent. of his 165 grades in the honor list. It is unjust to the student, to the instructor, or to the institution at large to distribute scholarships, class honors, or other meritorious "distinctions" on the basis of grades resulting from the personal opinions of instructors.

There is evident need of standardizing judgments in all school procedure and there must be definite scales, absolute units of value for school work, just as the mechanical field of endeavor has the foot-rule, galvanometer, thermometer, etc. Binet and Simon with their graded tests for general intelligence of children have led the way for the scientific study of mental attainments. The Russell Sage Foundation and school surveys have suggested means for measuring general school progress. Ability in school subjects is already being reduced to scientific measurement.[15] Until a measuring scale is established for each subject a more scientific method of grading than the personal judgment standard is necessary in order that all concerned may receive equal and just recognition for school work.

There are several approaches to a scientific method of grading and the one herein described is so nearly scientific that, until the intellectual yard-stick is standardized which will be constant at all times and places and with all trained individuals, it may be used to good advantage. It is a system that was adopted to overcome the persistency of instructors to distribute their grades according to personal opinion. It was when a professor of the University of Missouri "flunked" his entire class, and the Board over-ruled him by passing the entire class, that some one of the faculty urged the adoption of a scientific system of grading.

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[14] W. T. Foster. *Administration of the College Curriculum*, pp. 262, 266.
[15] Daniel Starch, *Educational Measurements*.

Since 1908 when the University of Missouri adopted a method and defined definitely the means of establishing various grades, many institutions have adopted similar plans which have for the most part satisfied the demands of the executives, the faculty, and the student body. The most recent adoption of a plan is by the George Washington University, and the following is taken from their announcement as published in the JOURNAL OF EDUCATIONAL PSYCHOLOGY.

The Committee on Standardizing Grades appointed in June submitted the following report March, 1914, on the following two problems: First, How can the amount of work for each unit of credit be approximately equalized in the various courses? Second, What common standard of grading can the various members of the faculty observe so that they will grade approximately the same standard?

From this report the following is quoted:

"In submitting principles and standards for the solution of these problems, the committee wishes, first of all, to be understood that it does not wish to dictate, or even to suggest, how any member of the faculty should do his work. It not only has no intention of curtailing the legitimate rights and freedom of any teacher, but it desires especially to emphasize that these rights and freedom are sacred; that they are an indispensable condition for the best type of university work. But in schools, colleges and universities the personal side is not the only side of teaching. There is present also a social side, which grows out of the fact that a school is in some fundamental aspects a social unit. The various members of the faculty are all working to contribute piecemeal to the same end. . . . Considered from the social standpoint, the college in common with other schools, performs two interrelated, and although distinguishable, fundamental functions. It (1) educates and it (2) selects. . .

"The giving of grades to students is only one of a number of means that the school uses in discharging the selective function of education, but it is one of the most important. Like other educational functions it must be done carefully, intelligently and uniformly in order to avoid injustice to the student. The desideratum of uniformity requires not only that each teacher always uses approximately the same standard with all of his students, but that all teachers use the same standard with all of

the students. When this is not done the educational equilibrium of the school is disturbed and injustice is done to the earnest and conscientious student. The less serious the students are, the more they tend to gravitate toward teachers that give the highest grades, and the injustice that this tends to work upon the conscientious student when it comes to the awarding of honors and the recommending for positions is obvious. The giving of many high grades, furthermore, gives many students a false and exaggerated notion of their ability. The grade "A" should be reserved for the very exceptional ability which in the nature of the case is rare.

"The principles underlying a uniform standard of grading are found in the distribution of mental ability as revealed by psychological investigations. These investigations have shown, when sufficiently large numbers are considered, that ability in general or in any particular line is distributed in the form of a bell-shaped curve, technically known as the probability curve or the normal curve of frequency. Letting the base line represent the degrees of ability from the poorest to the best and the vertical lines the number of persons possessing each degree of ability, there is, at best, but a small number of students with excellent ability, a large number with good ability, a relatively larger number with medium or average ability, a smaller number with sub-medium but passing ability and a smaller number with distinctly unsatisfactory ability.

"There are, of course, no sharp dividing lines between these groups. The grade of A or excellent should be assigned to about 4 per cent. of the students, B or good to about 24 per cent., C or medium to about 44 per cent., D or sub-medium to about 24 per cent. and E or failure to about 4 per cent. It is quite likely that the percentage of failure in the lower classes may properly be somewhat higher than that in the upper, with corresponding changes in the other percentages, and failures may perhaps also properly be more frequent in professional schools than in liberal culture schools. Because of its immediate social responsibility, it is the duty of the professional school to apply the principle of selection rigidly."

The Effect of This Report

As stated in the letter of transmission it was thought that the instructors would recognize the value of a uniform distribution

and that they would endorse and encourage the adoption of some system by their own willingness to approximate a suggested standard. This assumption is not justified by the distribution of grades for the night or day students for the second semester. While there seems to be a tendency to approximate nearer the normal distribution when the curve for the entire distribution for the second semester is plotted; yet the variation of distribution of the day grades with that of the night grades by the individual instructors is marked and seems to indicate that no conscientious effort was made to systematize the distribution. In fairness to all it might be said that during the second semester at the time when this report was circulated and for the remainder of the term the Dean was on sabbatical leave, so that the report received no official sanction other than it was sent out from the Dean's office at his request Many of the faculty, however, discussed the report with the author and all were familiar with the psychological testing of the first year students, and many availed themselves at faculty meetings and elsewhere of learning more definitely the type of mentality of their poorer students as determined by these tests.

It will be observed from the following figures that the combined distribution for the second semester gives "H" plus "M" an equal value with "P" plus "F" with fifty per cent. as the central distribution when grades "D," "R," and "Fa," representing conditions over which the instructor has little or no control, are left out of account.

	H	M	C	P	F	D	R	Fa	H	M	C	P	F
1st Sem.....	4	16	44	17	9	4	3	1	3	17	50	17	11
2d Sem.....	6	18	47	14	9	1	2	3	7	18	50	15	10

There has been a gradual shifting toward the upper end of the curve as indicated by the following tabulation which represents the distribution of day grades for both semesters of each year:

	H	M	C	P	F	D	R	Fa
1912–13.....	3	15	46	15	10	3	4	4
1913–14.....	3	17	45	15	10	3	5	2
1914–15.....	4	18	47	14	9	1	2	3

And while the grades for the second semester 1914–15 tend to show progress in this direction it can hardly be ascribed to the results of this report. Plate IV presents the distribution of grades for the first and second semesters, day courses for the

Plot N

INSTRUCTORS

HONOR | MERIT | CREDIT | PASSED | FAILURE

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

"TEC" CROSS SECTION 10 X 10 TO 1 INCH

"TEC" CROSS SECTION. 10 X 10 TO 1 INCH.

years 1912–13, 1913–14, and 1914–15 and the total distribution for both semesters of the night courses for the years 1912–13 and 1913–14, but only the second semester for 1914–15 The grades for the second semester, night are given instead of the total distribution for the night courses for 1914–15 for the reason that it is desired to show a second attempt at grading after the report on the advisability of some uniform grading system was made known to these instructors. The distribution for the night grades is shown in black. Of the eighty-three instructors that assigned the 31,391 grades—the total number considered in this report—only twenty-six have been with the institution long enough to assign grades for each semester of the three years. Of these one taught only night courses, another only day courses. The marks of four others, whose grading shows no pecularities compared with the others recorded in Plate IV, are omitted for the sake of brevity. In an institution where the faculty is constantly changing it is obvious that many difficulties arise in any attempt to enforce uniformity; but at the same time there is a greater need for uniformity in such an institution in order that the ever changing instructors may readily know the quality and the amount of work to be exacted. From a careful study of Plate IV, I am led to believe that there has been no conscious attempt made to assume a normal curve of distribution for the two final gradings after this report was made known. It is evident that the strong appeal made by the Committee of the George Washington University had little or no weight on the grading by the faculty of the Carnegie Institute of Technology. Personal opinion seems to be the only standard they were willing to use.

From the foregoing study the following points are summarized:

1. Grading for the vast majority of teachers is based on personal opinion.
2. Personal opinions are influenced more by temperamental attitude than by the nature and type of subject matter taught.
3. Elimination due to failure is unjust, especially when failure is determined by the teacher's personal opinion.
4. The granting of honors, etc., is debasing when the curve for graduation deviates so markedly from the distribution curve of all students as at Carnegie.

5. Night students ought to have a different standard from that of day students.
6. Shop instructors as a class are less exacting than academic instructors.
7. Instructors in shop subjects vary their grades as much as do academic instructors.
8. Distribution of ability as shown by grades assigned is not in conformity with ability as indicated by psychological tests.
9. Instructors are not willing to burden themselves with standardization of their grades so long as the institution is willing to accept haphazard personal judgments.
10. The distribution of grades by the entire faculty can hardly be considered a true curve for that institution since some instructors may distribute their grades so widely that they destroy the educational equilibrium of the school.
11. A curve of distribution can be based on the mental ability of the students as shown in some well devised psychological tests; or on a curve as established by a distribution of grades within that institution covering a number of years.
12. Such curves of distribution are fairer to the students and the institution than some arbitrary standard as suggested at Missouri, George Washington and other institutions which base their curve on the normal surface of frequency. If the entrance requirements have been selective of a group then the normal distribution curve is not an adequate distribution.
13. A curve based on psychological tests limits the standard of the institution to the type of general mental ability of the students. This may be very beneficial to the student but what would eventually be the standard of the institution?
14. A curve based on the former grades of an institution upholds the traditions of the institution but is not just in the long run to many of the students.
15. A curve which expresses the correlation of mental tests of the students within the institution with the distribution of grades as assigned by many instructors through many years ought to give a distribution which would maintain

the traditional standards of that institution and at the same time give the individual student full justice. Once this curve is established the entrance requirements can be measured by it in order to eliminate some of the wasteful teaching in the earlier years. "About one-third of all elimination is caused by the fact that the scholarship rating of the freshmen at the university is only one-third of the rating of the same student in the last year of high school, when based upon the actual amount of time spent in study. The serious break in a student's standing when he enters the university tends to discourage him and to drive him out of school. The university should raise its scholarship rating of freshmen students about 10 per cent., or one letter, according to the system of marking in use, and the high schools should lower that of their senior classes about the same amount. This would close the unnatural and harmful breach between them, and would reduce the large percentage of elimination."[16]

[16] E. D. JENNINGS. *Elimination of Freshmen from the University of Texas.* JOURNAL OF EDUCATIONAL PSYCHOLOGY, April, 1915, p. 221.

THE MEASUREMENT OF ABILITY IN LATIN. PART II. SENTENCE TESTS.

V. A. C. HENMON

The University of Wisconsin

The measurement of ability to understand or translate Latin may be attempted in several ways. A passage of connected discourse may be selected, as Mr. H. A. Brown, of the Department of Public Instruction, Concord, New Hampshire, has done,[1] or an appropriate list of sentences may be constructed or selected. In either case the measurement may be in terms of speed or accuracy of translation. The passages or sentences may be used further as a basis for tests of knowledge of grammar. The results to be reported in this study are based on two sets of sentences, one of thirty sentences and the other of fourteen (reduced from fifteen through a typographical error in one of the sentences) and the measurement is in terms of accuracy of translation solely.

Latin Sentence Tests

One of the underlying purposes of the detailed study of vocabularies, which resulted in the list of 239 words in the Standard Vocabulary, was the use to which the list might be put in constructing sentences and testing ability in translation and knowledge of grammar. It was felt that to be most useful the sentences should not contain words that the pupil had not come in contact with and could not reasonably be expected to know. Hence, sentences were built up using no words not contained in the list of 239. From a considerable number of such sentences a selection of thirty sentences was made with the advice and counsel of Latin teachers. The design was to select a few sentences so easy that they would be gotten by a very considerable number of first year pupils and also a few sentences so difficult that they would be missed with considerable frequency by fourth year pupils. The intermediate sentences were graduated in difficulty as nearly as this could be done by the estimates of a few teachers. It was hoped that from this list when given to a large number of pupils in each year two sets might be secured, one of ten sentences grading up in difficulty by fairly uniform

[1] Brown, H. A. In an unpublished study reported at the meeting of the A. A. A. S., New York, December, 1916.

steps, and another of ten sentences that would be approximately equal in difficulty and would show, moreover, progressive increase in difficulty from the first year to the fourth. This design has not as yet been fully realized. A much larger number of sentences must be constructed and tried out with pupils before it can be realized. In the meantime the results so far obtained are worth reporting.

The first list of thirty sentences was as follows:

LATIN SENTENCE TEST—A.

1. Puer bonus est.
2. Filius patris similis erit.
3. Illi homines duos amicos habebant.
4. Hi omnes magnae virtutis erant.
5. Haec urbs multo maior eo oppido erat.
6. Equites urbem hostium magna cum virtute oppugnaverant.
7. Nihil novi de bello audivi quod non in urbe fui.
8. Huic viro multi servi erunt.
9. Este fortes, milites, et tela longissime conicite.
10. Ille dux nomine sed non factis amicus erat.
11. Nuntius matri dixit filium noctu venturum esse.
12. Dic mihi quid tibi in animo sit.
13. Periculis multis in vita superatis mortem non timebit.
14. Navem post primam lucem non relinquebant, ne viderentur et audirentur.
15. Cum in urbem venissem et ibi de principis fortuna bona certior factus essem, domum ivi.
16. Castra consulum a nostris paucis diebus capientur.
17. Cum miles fortiter in bello pugnavisset ad domum profectus est.
18. Rogas cur proelium nunc relinquere velim.
19. Cur te in his periculis non defendisti?
20. Auxilium mittet ne hostes urbem capiant.
21. In eo loco ad multam noctem se defenderunt.
22. Nonne vereris ne omnem fortunam amittas?
23. Velim fratrem tuum roges, ne nos relinquat.
24. Scit te saepe nomen imperatoris huius audivisse.
25. Centum naves corpora armaque quae post proelium in agris relicta erant contulerunt.
26. Nihil habeo quod populo dem.
27. Alii alia dixerunt sed omnes eum magna virtute esse sciebant.
28. Dicere non possum quam diu pater meus in eo loco fuerit.
29. Si imperator esses, daresne proeli committendi signum?
30. Qui bonum cum potest non defendat non laudandus est.

This list contained too few easy sentences for first year pupils. In fact, an astonishingly large percentage of pupils tested in June were unable to translate more than the first sentence. The first sentence was correctly translated by 97 per cent. of first year pupils, the second by 52 per cent. and the third by 50 per cent. The remainder range below 50 per cent. correct. Even for third and fourth year pupils the percentages for all but the first two sentences are low.

A second list of fourteen easier sentences was prepared as follows:

LATIN SENTENCE TEST—B

1. Homo malus est.
2. Navis parva est.
3. Via erat longa et lata.
4. Sunt viri fortes.
5. Tuum fratrem non video.
6. Amicus pueri nuntius erat.
7. Ubi sunt copiae hostium?
8. Mors finis esse videtur.
9. Pater vocat filium.
10. Dux dicitur pervenisse.
11. Filia parva in periculo est.
12. Servum misit quem secum habebat.
13. Id dictu quam factu facilius est.
14. Dixit se dare quod peterent.

Even this list as the tables below indicate does not contain enough sentences sufficiently easy to supply the desired steps at the lower end of the scale.

Test A was given in June, 1916, and 1917, in seventeen schools to 262 first year, 244 second year, 94 third year and 74 first year pupils. Test B was given in June, 1917, in sixteen schools to 412 first year, 261 second year, 105 third year and 78 fourth year pupils. In checking the papers which were returned to me no attempt was made to devise a plan to score sentences as partly correct. The sentences were scored either as right or wrong. The results for Test A appear in Table I, giving the median number correct, the average number correct, and the number of pupils. Table II sets forth the same facts for Test B. The letters designating the schools are the same as in the Vocabulary Test.

The application of standard tests and scales in elementary subjects has shown astonishing variations in schools and pupils and great overlapping of abilities from year to year. The same striking variability is shown in the relatively more highly selected secondary school pupils in Latin. An inspection of the tables shows some surprising facts. The first year pupils in School O do better in Test A than the third and fourth year pupils in three other schools and the second year pupils in seven. In Test B the first year pupils of the same school surpass the third and fourth year pupils in all but two schools. The range of the medians in Test A for the different schools from 1 to 11 correct in the first year, 4 to 19 in the second, 6.5 to 24 in the third and 3 to 25 in the fourth, shows a surprising state of affairs. As is shown for other purposes in Table V below the overlapping from year to year is marked. In Test B forty per cent. of first

TABLE I.

Test A

School	Medians				Averages				No. of Pupils			
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
B.....	6	11	20.5	23	6.0	10.2	19.3	25.4	55	41	8	8
C.....	4	7	16	12.5	4.1	7.5	16.9	12.2	46	28	14	6
E.....	2	4	....	3	2.3	5.2	....	2.9	20	35	..	7
F.....	2	5	11.5	....	2.1	5.6	11.0	....	9	9	6	..
G.....	..	12	....	....	...	12.7	....	....	..	25	..	1
H.....	1	6	7.5	9	1.6	7.2	8.7	9.3	5	5	6	3
I.....	5	15	....	20.5	6.1	12.2	....	21.0	11	4	1	4
J.....	3	11.5	15	20	3.4	11.2	15.0	21.2	23	10	2	5
K.....	2	8	20	22	2.3	8.5	20.8	21.0	21	19	5	8
L.....	1	4	9	12.5	2.1	4.4	10.0	12.5	9	12	5	4
M.....	3	4	6.5	19.5	4.0	6.5	11.4	19.4	13	10	14	8
N.....	5	4.5	13.5	19	6.8	7.9	12.4	19.0	24	18	12	7
O.....	11	19	24	25	11.9	18.1	23.8	26.2	17	18	9	9
P.....	6	12.5	21	21	5.9	13.2	18.3	21.0	9	4	3	2
Q.....	..	....	20	....	...	....	18.8	....	..	..	9	..
R.....	..	11	....	....	...	14.2	....	....	..	6	..	..
S.....	..	....	....	10.5	...	....	....	10.5	..	..	..	2
	4	7	16	20	4.9	9.3	15.3	18.2	262	244	94	74

TABLE II.

Test B

School	Medians				Averages				No. of Pupils			
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
B.....	9.5	11	12	12	9.9	10.4	10.9	11.7	54	51	20	12
C.....	6	9	11	12	6.0	9.0	10.8	12.3	65	32	10	8
D.....	6	7	11	12	5.7	7.5	10.5	11.7	42	21	11	12
E.....	6	5	9	..	6.1	5.8	9.2	....	37	24	11	1
G.....	8	9.5	..	..	8.8	9.8	....	....	50	24	..	1
H.....	3	6	6	10	3.0	6.0	6.8	10.0	5	5	6	3
I.....	8	8.5	..	11.5	7.6	8.2	....	10.7	11	4	1	4
J.....	5	8.5	12.5	13	5.8	8.4	12.5	12.8	23	10	2	5
M.....	4	6	9	12	4.6	5.9	8.8	11.5	13	10	14	8
N.....	8	6	9	12	8.0	6.3	9.2	10.9	25	19	12	7
O.....	12.5	14	14	13	11.8	13.0	13.4	13.3	18	18	9	9
P.....	8	11.5	11	11	7.4	11.5	11.0	11.0	9	4	3	2
Q.....	8	....	....	....	8.3	....	....	....	11	..	..	..
R.....	..	11	....	....	....	9.4	....	....	..	5	..	..
S.....	11	....	....	11.5	10.8	....	....	11.5	10	..	..	2
T.....	11	9	12	11	10.4	8.5	11.3	10.5	39	34	6	4
	8	9	11	12	7.8	8.8	10.2	11.6	412	261	105	78

year pupils reach or exceed the median ability of the second year, twenty-two per cent. that of the third year and fifteen per cent. that of the fourth year. On the other hand, there are in the same test thirty-five per cent. of second year pupils and seventeen per cent. of third year pupils who do not reach the median ability of the first year. The range of variation by pupils in Test A is very great, from none correct (six pupils) to twenty-four sentences correct for the first year, from one (eight pupils) to twenty-seven (three pupils) for the second year, from one (two pupils) to twenty-nine for the third year, and from one to thirty in the fourth year. In Test B the ranges are for the first year from none correct (six pupils) to fourteen correct (sixteen pupils) for the second year from one to fourteen, for the third year from three to fourteen and for the fourth year from five to fourteen. Figures 1 and 2 show graphically the distribution and overlapping for each year in the two tests.

Arrangement of Sentences in Order of Difficulty and Determination of Scale Values

The averages and medians in Tables I and II are given in terms of the number correct, regardless of the varying difficulty or the weight to be assigned to each sentence. To determine this weight the same method substantially as was employed in scaling the words in the Vocabulary Test was used with the sentences. The same two assumptions were made: viz., that ability to translate Latin is distributed normally, and that the real variability for each year is approximately the same. The per cent. of times each sentence was translated correctly being known, its position on the base line of the normal surface of frequency in terms of P. E. deviations above or below the median was determined. In order to obviate the disadvantages of working with minus and plus values —3.8 P.E., was, as with the words, taken as a point of reference or zero point. Tables III and IV give the percents correct for each sentence, for each year, and the corresponding year scale values obtained by subtracting the P. E. equivalents of the percents correct from —3.8 P.E., as indicated above.

The last column headed General Scale Values gives the position of each sentence for the four years combined when referred, first, to the median of the first year and then to eliminate minus

Fig. I
Test A.

Showing Overlapping of Abilities in Successive Years

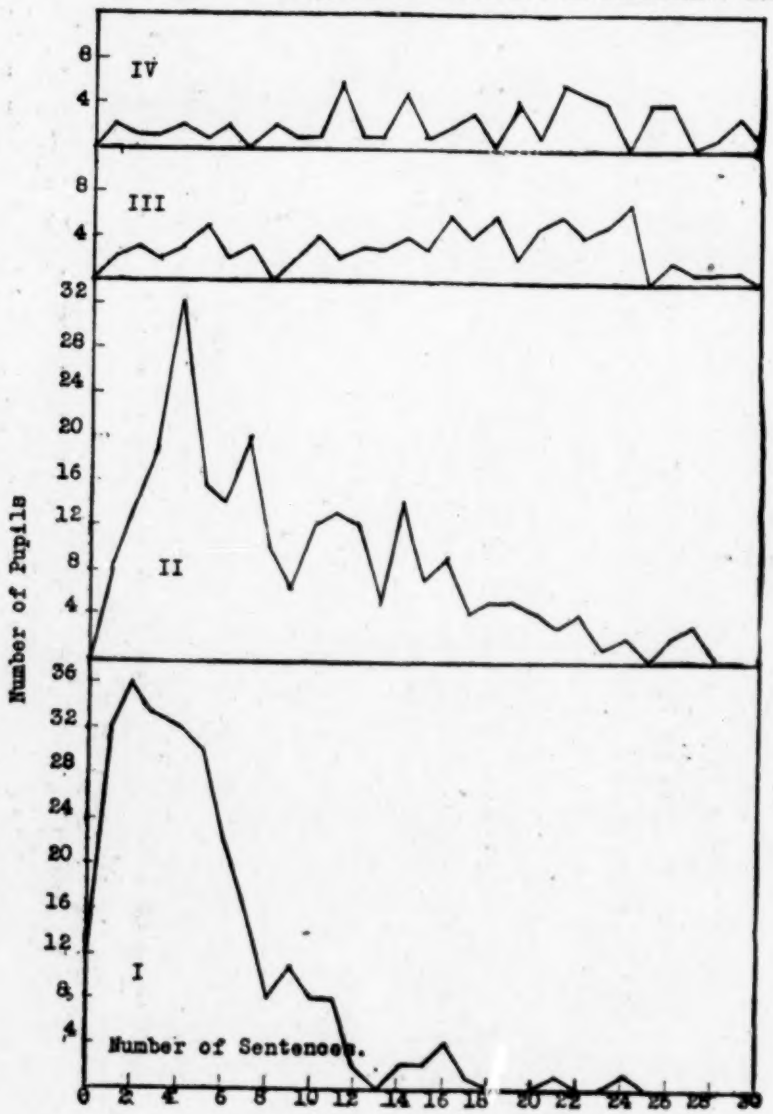

Fig. II.
Test B.

Showing Overlapping of Abilities in Successive Years.

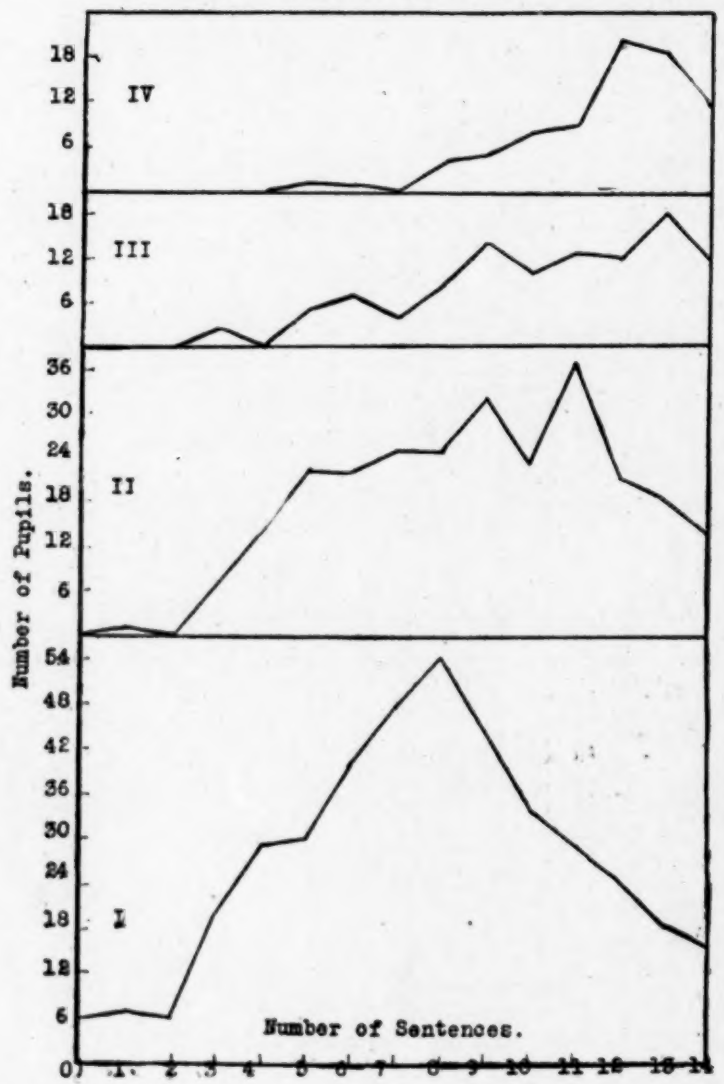

TABLE III.

Sentence Test A

	Percents Correct				Year Scale Values				General Scale Values
	I.	II.	III.	IV.	I.	II.	III.	IV.	
1.	97.0	97.6	100.0	100.0	1.0	.9	0	0	.0
2.	52.3	57.0	75.5	79.6	3.7	3.5	2.8	2.6	2.7
3.	50.0	48.4	57.4	58.1	3.8	3.9	3.5	3.5	3.2
4.	28.6	70.1	73.4	74.3	4.6	3.0	2.9	2.8	2.9
5.	32.9	45.5	55.3	57.7	4.5	4.0	3.6	3.5	3.4
6.	35.9	61.9	60.6	66.2	4.3	3.4	3.4	3.2	3.1
7.	25.6	78.3	65.9	66.2	4.8	2.6	3.2	3.2	3.0
8.	25.6	41.0	42.6	40.5	4.8	4.1	4.1	4.2	3.8
9.	10.3	32.4	50.0	64.8	5.7	4.9	3.8	3.2	3.9
10.	8.8	26.2	54.3	70.2	5.8	4.7	3.6	3.0	3.8
11.	14.5	36.9	51.1	61.7	5.4	4.3	3.8	3.4	3.7
12.	10.3	25.0	76.6	83.7	5.7	4.8	2.7	2.3	3.4
13.	7.6	25.4	51.1	66.2	5.9	4.8	3.8	3.2	3.9
14.	3.1	29.5	52.1	63.5	6.6	4.6	3.7	3.3	4.1
15.	3.8	29.1	46.8	63.5	6.4	4.6	3.9	3.3	4.1
16.	11.1	12.3	28.7	40.5	5.6	5.5	4.6	4.2	4.5
17.	14.5	50.0	67.0	67.5	5.4	3.8	3.1	3.1	3.4
18.	2.3	18.4	54.3	74.5	6.8	5.2	3.6	2.8	4.1
19.	12.2	20.1	41.5	52.7	5.5	5.0	4.1	3.7	4.1
20.	18.7	16.4	38.3	50.0	5.1	5.3	4.2	3.8	4.1
21.	3.4	36.9	38.3	48.6	6.5	4.3	4.2	3.9	4.2
22.	1.9	15.6	55.3	51.3	6.9	5.3	3.6	3.8	4.4
23.	1.1	15.6	42.6	64.8	7.2	5.3	4.1	3.2	4.6
24.	5.0	13.9	46.8	58.1	6.2	5.4	3.9	3.5	4.3
25.	2.7	11.1	26.6	41.9	6.7	5.6	4.7	4.1	4.8
26.	1.9	11.1	56.4	55.4	6.9	5.6	3.6	3.6	4.5
27.	.4	12.7	27.7	36.5	7.7	5.5	4.7	4.3	5.1
28.	5.0	10.7	37.2	55.4	6.2	5.6	4.3	3.6	4.5
29.	1.5	15.6	28.7	31.1	7.0	5.3	4.6	5.0	5.0
30.	.4	4.5	24.5	72.9	7.7	6.3	4.8	2.9	5.0
					170.4	137.1	110.9	100.2	115.6

TABLE IV.

Sentence Test B

	Percents Correct				Year Scale Values				General Scale Values
	I.	II.	III.	IV.	I.	II.	III.	IV.	
1.	90.6	93.7	94.2	89.7	1.8	1.5	1.5	1.9	.5
2.	88.5	93.7	89.5	94.7	2.0	1.5	2.0	1.4	.6
3.	78.7	82.0	76.2	85.9	2.6	2.4	2.8	2.2	1.4
4.	78.5	85.5	80.0	93.6	2.6	2.2	2.6	1.6	1.1
5.	57.1	61.1	83.8	93.6	3.5	3.4	2.3	1.6	1.6
6.	62.7	49.5	65.7	71.8	3.3	3.8	3.2	2.9	2.2
7.	74.8	90.6	87.6	94.7	2.8	1.8	2.1	1.4	.9
8.	25.8	28.6	71.4	78.2	4.8	4.6	3.0	2.7	2.6
9.	64.4	60.8	72.4	84.6	3.3	3.4	2.9	2.3	1.8
10.	22.1	29.8	52.4	60.3	4.9	4.6	3.7	3.4	3.0
11.	63.7	65.0	58.1	70.5	3.2	3.2	3.5	3.0	2.1
12.	29.6	61.9	78.1	91.0	4.6	3.4	2.7	1.8	2.0
13.	30.9	48.4	57.1	80.8	4.5	3.9	3.5	2.5	2.5
14.	13.9	43.0	58.1	74.4	5.4	4.1	3.5	2.8	2.8
					49.3	43.8	39.3	31.5	25.1

and plus signs to the easiest sentence; *viz.*, the first sentence in Test A. In order to determine the average position of each sentence when referred to the first year median the size of the intervals between the medians of the different years had to be determined. Tables V and VI show the number and percents of pupils in each year who reach or exceed the median score in each of the other three years and the P.E. equivalents of the percentages (Tables V and VI). As in the case of the words, six direct and derived P.E. values expressing the intervals between each year were averaged to determine the most likely distance at which the medians of the second, third and fourth years lies above the first year median. These distances are as follows:

	M I–II	M I–III	M I–IV
Test A	1.151 P.E.	2.490 P.E.	3.011 P.E.
Test B	.479 P.E.	1.327 P.E.	2.127 P.E.

TABLE V.

Test A

Number and Percent in Each Year Reaching or Exceeding the Median of Every Other Year and the P. E. Equivalents

		I.	II.	III.	IV.
I.	No.	.....	64	7	2
	Percent	.....	24.4	2.7	0.8
	P.E.	.....	+1.028	+2.857	+3.571
II.	No.	203	.....	42	19
	Percent	83.2	.....	17.2	7.8
	P.E.	—1.427	.....	+1.403	+2.103
III.	No.	87	77	.....	32
	Percent	92.6	81.9	.....	34.0
	P.E.	—2.145	—1.351	.....	+ .612
IV.	No.	70	65	47	.....
	Percent	93.2	87.8	63.5	.....
	P.E.	—2.211	—1.728	— .512	.....

The general scale value was obtained by adding to the P.E. values of the sentences for the second, third and fourth years the intervals between the medians of these years and the first year. The average of the four values for each sentence thus obtained gives its position for the four year combined. The average position of the first sentence in Test A is —1.667 P.E. Taking this position as a point of reference or zero point to eliminate minus and plus signs, the general scale values indicate the distances at which each of the sentences lies above this point in terms of units of P.E. Sentences such as 18, 19, and 20, in Test A have

TABLE VI.

Test B

Number and Percent in Each Year Reaching or Exceeding the Median of Every Other Year and the P. E. Equivalents

		I.	II.	III.	IV.
I.	No.	.....	167	89	60
	Percent	.....	40.5	21.6	14.6
	P.E.	.....	+ .357	+1.165	+1.563
II.	No.	170	.....	90	53
	Percent	65.1	.....	34.5	20.3
	P.E.	— .575	.....	+ .592	+1.232
III.	No.	87	79	.....	42
	Percent	82.9	76.2	.....	40
	P.E.	—1.409	—1.057	.....	+ .376
IV.	No.	76	72	59	.....
	Percent	97.4	92.3	75.6	.....
	P. E.	—2.881	—2.114	—1.028	.....

the same position on the scale, 4.1 or, in other words, are of the same degree of difficulty. Again the difference between sentences 2 and 5 is equal to the difference between sentence 15 and 16.

The sentences may be used practically in a variety of ways. Either or both of the sets may be used as they stand and comparisons may be made with performances in typical schools. The weights or scale values to be given each sentence either for each year singly or for the four years combined are known. Thus, if Test B is used as it stands, for correctly translating the entire set 25.1 points would be the perfect score toward which for each sentence correctly translated the pupil would receive the points indicated in the general scale. If comparisons are to be limited to a single year the total of the scale values for that year and the values for each sentence can be used in the same way. The scores can readily be translated into percentages to conform to the usual methods of rating in schools if this is preferred. Any combination of sentences may be made at the discretion of the teacher and the scores used in the same way. A little calculation from Tables III and IV will give the scores obtained with these sentences in the schools tested in this study.

Two arrangements of ten sentences each of equal difficulty and grading up by fairly uniform steps are available by selection from the two lists. These arrangements with the scale values are as follows:

LATIN SENTENCE TEST I.

1.	Ubi sunt copiae hostium?	1.0
2.	Via erat longa et lata.	1.4
3.	Pater vocat filium.	1.8
4.	Amicus pueri nuntius erat.	2.2
5.	Mors finis esse videtur.	2.6
6.	Nihil novi de bello audivi quod non in urbe fui.	3.0
7.	Dic mihi quid tibi in animo sit.	3.4
8.	Ille dux nomine sed non factis amicus erat.	3.8
9.	In eo loco ad multam noctem se defenderunt.	4.2
10.	Velim fratrem tuum roges, ne nos relinquat.	4.6
		28.0

LATIN SENTENCE TEST II.

1.	Navis parva est.	.6
2.	Sunt viri fortes.	1.1
3.	Tuum fratrem non video.	1.6
4.	Filia parva in periculo est.	2.1
5.	Id dictu quam factu facilius est.	2.5
6.	Equites urbem hostium magna cum virtute oppugnaverant.	3.1
7.	Nuntius matri dixit filium noctu venturum esse.	3.7
8.	Navem post primam lucem non relinquebant, ne viderentur et audirentur.	4.1
9.	Nihil habeo quod populo dem.	4 5
10.	Alii alia dixerunt sed omnes eum magna virtute esse sciebant.	5.1
		28.4

When the tests are given the results may be scored in several ways. The score may be indicated simply by the number of sentences or steps passed. Thus if a pupil translates correctly the first six sentences his score would be six. If he misses the seventh but gets the eighth his score would be seven. He is credited with the eighth but penalized for missing the seventh.

A better method of scoring is to give for each sentence correctly translated its scale value and his score would then be the sum of these values. If the pupil translates the first six sentences in Test I correctly his score would be 12.0 with a perfect score 28.0. This can of course be expressed in percentages if preferred. Average scores by this method for the two tests based on the results indicated in the Tables would be as follows:

TEST I.

Year	I.	II.	III.	IV.
Percent correct.....	35.6	49.3	65.1	74.9
Score.....	10.0	13.8	18.2	21.0

TEST II.

Percent correct.....	37.5	50.6	61.6	71.7
Score.....	10.6	14.4	17.5	20.4

The selection of a list of ten sentences all equal in difficulty would be very useful for testing purposes. The number of sen-

tences studied is not sufficiently large to furnish such a list. However, the following ten sentences not mentioned in the above twenty do not differ very greatly:

LATIN SENTENCE TEST III.

1.	Huic viro multi servi erunt.	3.8
2.	Este fortes, milites, et tela longissime conicite.	3.9
3.	Periculis multis in vita superatis mortem non timebit.	3.9
4.	Cum in urbem venissem et ibi de principis fortuna bona certior factus essem, domum ivi.	4.1
5.	Rogas cur proelium nunc relinquere velim.	4.1
6.	Cur te in his periculis non defendisti?	4.1
7.	Auxilium mittet ne hostes urbem capiant.	4.1
8.	Scit te saepe nomen imperatoris huius audivisse.	4.3
9.	Nonne vereris ne omnem fortunam amittas?	4.4
10.	Dicere non possum quam diu pater meus in eo loco fuerit.	4.5

Scores in terms of the number correct and ignoring the small differences in difficulty between the sentences would be as follows:

TEST III.

	I.	II.	III.	IV.
No. correct.....	.9	2.2	4.6	5.8

This list is too difficult to be very satisfactory and will not be as useful as Tests I and II.

In an ideal scale of the type represented by Tests I and II the sentences should grade up by fairly uniform steps. Thus the fifth sentence in Test II gives the following percentages correct for each of the four years: 30.9, 48.4, 57.1, 80.8. It is a very satisfactory sentence. On the other hand the sixth sentence gives the following percentages: 35.9, 61.9, 60.6, 66.2. It shows an inversion in the third year and the graduation is imperfect. It will require experimentation with several hundred sentences to arrive at a genuinely satisfactory scale. Moreover, it is desirable to secure various alternative lists as a few hours coaching on the tests would naturally vitiate their value. My purpose is to accumulate in time results from a large number of sentences built up from the 239 standard words. In the meantime these sentences and tests should be useful for teachers and students of education.

A REPORT ON THE USE OF THE KANSAS SILENT READING TESTS WITH OVER ONE HUNDRED THOUSAND CHILDREN

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This report on silent reading is based upon the use of the Kansas Silent Reading Tests (devised by F. J. Kelly) during the years 1915–'16 and 1916–'17. Within this time more than 700,000 copies of these tests have been distributed by the Bureau of Educational Measurements and Standards. Out of the total number of tests distributed, reports have been received from more than 100,000 pupils in 160 cities. These tests are so well known that they will be described only briefly here. An account of their derivation may be found in the JOURNAL OF EDUCATIONAL PSYCHOLOGY for February, 1916. Sample copies of these tests may be obtained from the Bureau of Educational Measurements and Standards, Emporia, Kans.

Three tests make up the series. Test I is for grades 3, 4, 5; Test II, for grades 6, 7, 8; and Test III, for grades 9, 10, 11, 12. Each tests consists of sixteen exercises. The exercise requires the pupil to make a definite response. The tests may be said to be objective in the sense that there is little opportunity for differences of opinion in marking the test papers. The nature of the exercises is illustrated by the following selected from Test II:

No. 1.

Value	
1.0	The air near the ceiling of a room is warm, while that on the floor is cold. Two boys are in the room, James on the floor and Harry on a box eight feet high. Which boy has the warmer place?

No. 3.

Value	
1.6	We can see through glass, so we call it transparent. We can not see through iron, so we call it opaque. Is black ink opaque, or is it transparent?

No. 7.

Value	
2.4	A boy goes to school in the morning, goes home at noon for lunch, returns to school at 1 o'clock and returns home at 4 o'clock. How many times does he travel between home and school that day?

No. 11.

"The curfew tolls the knell of parting day,
The lowing herds wind slowly o'er the lea,
The ploughman homeward plods his weary way,
Value And leaves the world to darkness and to me."—(*Gray.*)
4.0 Study the above quotation carefully. The author lets us know his feeling about the coming of night. If you think his feeling is one of fear and dread, underscore curfew. If his feeling is one of peace and gladness, underscore ploughman.

It will be noticed that each exercise has been evaluated in terms of a common unit. A pupil's score is the sum of the values of the exercises which the pupil does correctly in five minutes. In Table I there are given the median scores for the first-, second-, and third-class cities of Kansas, for Iowa, and for the other states by groups. In addition to the median scores there is given the number of pupils taking the tests in each group of states. The total number of scores included in this table is more than 100,000. In most of the cities all the pupils enrolled in the several grades were tested, or in the case of some of the larger cities the tests were given to a sufficient number of pupils to make certain the representative character of the results. In the case of a very few cities the tests were secured by individual teachers and given only to the pupils in one or two buildings.

Strictly speaking a score is not a measure of a pupil's ability. A score represents only a pupil's performance at a given time under given conditions. Any change of conditions will produce corresponding changes in his performance. Conditions include such things as the time allowance, physical conditions, temperature, humidity, lighting, and the emotional status of the pupil. In general it is probable that standard conditions have prevailed in the giving of the tests, but in the case of particular pupils it no doubt has happened that conditions were not standard. Possibly the pupil's own physical condition was not standard, or his pencil point may have broken, or his emotional status may have not been standard, or he may not have possessed at this particular time his normal mental alertness.

The presence of many of the standard conditions depends upon the examiner, and it may have happened that certain examiners produced conditions which materially affect the scores of the pupils whom they tested. They may have done this by urging the pupils to work rapidly in giving the directions for the test or by suggesting to the pupils that they were in competition with pupils in other schools. It may be that some examiners, because

they felt rather excited themselves, made the pupils unduly excited.

Performance, therefore, is subject to wide variations. Ability can not be measured. It can be inferred accurately from performance only when we know of the conditions attending the performance. We may assume that standard conditions prevailed, but in making inferences regarding the ability of particular pupils or particular classes, the fact of this assumption must not be forgotten.

A few of the very high medians may be due to the fact that the pupils tested were not representative of the schools. In some cases it appears probable that the high median is due to the fact that they are based upon scores from only a small number of pupils who are clearly not representative of their group. For example, this is doubtless true of the tenth-grade median for Kansas second-class cities and of the twelfth-grade median of the southern states. The total medians and the medians for Kansas and Iowa are represented graphically in Fig. 1. The total medians are represented by the heavy solid line, the Kansas medians by the light solid line, and the Iowa medians by the broken line. In studying this figure it should be remembered that Test I was used for grades 3, 4, 5, and Test II for grades 6, 7, 8. This change in tests probably accounts for the apparent lack of increase in ability to read silently from grade 5 to grade 6. A similar change of tests occurs between the eighth and ninth grade, but apparently this change did not affect the scores in the same way as the change of tests at the sixth grade.

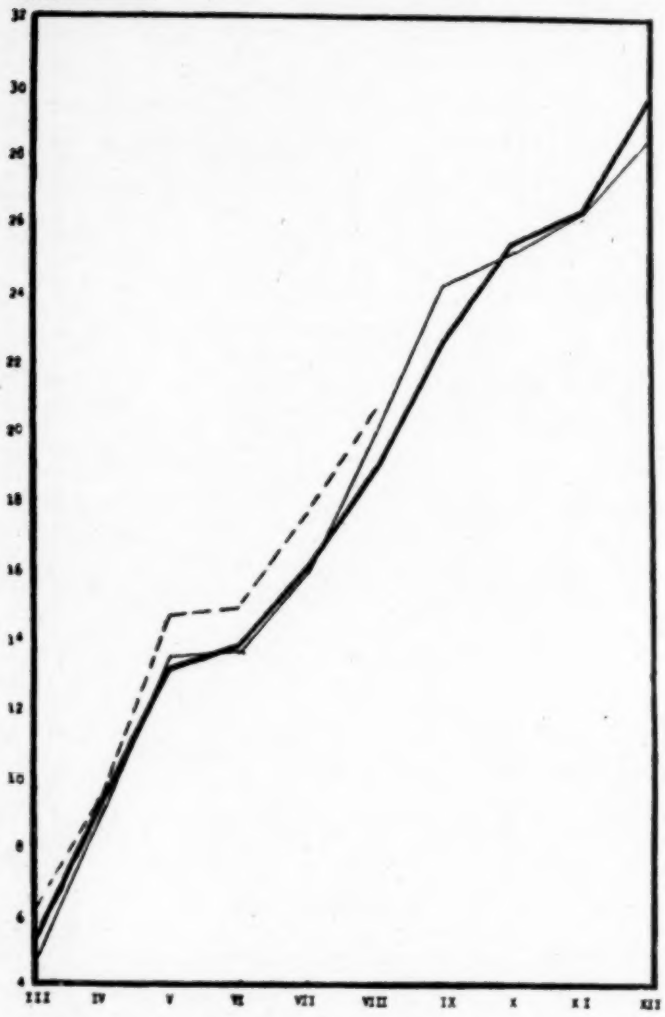
The median scores for Kansas agree very closely with the total median scores. It is interesting to note that the median scores for Iowa are conspicuously above the total medians and the Kansas medians. A similar condition exists in the case of arithmetic.[1] Apparently the public schools of Iowa are able to do superior work in these subjects.

The reports from the several states have been grouped into five sections and the median scores for each group given in Table I. The median scores for the several groups of states agree rather closely, on the whole, where the number of pupils tested is one hundred or more. There are, however, some slight variations which are rather interesting. The median scores for the

[1] See Second and Third Annual Report of the Bureau of Educational Measurements and Standards, Kansas State Normal.

Figure 1

Showing the median scores for Kansas Silent Reading Tests. Medians based on over 100,000 scores. Kansas————, Iowa- - - - - - - -; total————.



South Atlantic states are, on the whole, the lowest. It was hoped that we would secure some additional reports, since the medians given here are based almost entirely upon reports from one large southern city. This fact may be sufficient to account for the low medians.

The medians for the Western states are among the highest. Just why these medians should be so much higher than the medians from the other sections of the country is not clear. It may be that the medians are not based upon reports from representative cities. Another possible reason is that in other sections of the country children of foreign parentage are more of a factor. In cities where there are a considerable number of children of foreign parentage it has been found that in general lower scores are made.

Ability to read silently involves two factors: First, rate of silent reading; and second, understanding or comprehension of

TABLE I.

Kansas Silent Reading Test, Median Scores Based on Over 100,000 Scores

	III.		IV.		V.		VI.		VII.	
	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils
Kansas:										
First-class cities...	4.5	1,873	8.8	2,018	13.1	1,819	13.8	1,590	16.1	1,546
Second-class cities..	5.9	966	9.7	1,067	14.3	994	14.3	1,024	17.3	613
Third-class cities...	4.6	373	8.2	524	11.8	471	12.5	518	14.0	352
Kansas total....	4.9	3,212	9.0	3,609	13.4	3,284	13.7	3,132	16.1	2,511
Iowa.....	6.2	2,371	9.5	2,940	14.6	2,695	14.8	2,597	17.7	2,143
South Atlantic states.	6.0	398	9.2	350	13.9	332	11.6	326	14.5	179
North Atlantic states.	5.3	5,780	9.6	3,658	12.9	4,020	13.6	3,168	16.7	3,183
South Central states.	4.7	686	8.4	723	12.3	702	11.8	602	15.4	498
North Central states.	5.1	6,358	9.3	6,453	13.1	6,540	13.6	5,762	16.2	5,374
Western states.....	6.1	2,282	10.6	2,509	14.4	2,643	15.0	2,673	18.0	2,508
Grand total.....	5.3	21,087	9.5	20,242	13.2	20,216	13.9	18,260	16.2	16,396

TABLE I.—Concluded

	VIII.		IX.		X.		XI.		XII.	
	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils
Kansas:										
First-class cities....	19.7	1,334	25.3	317	27.1	199	27.8	201	29.7	115
Second-class cities.	20.6	596	33.7	72	33.6	32	....	.....	.....	.....
Third-class cities...	20.6	560	20.6	346	23.7	289	26.0	262	27.6	250
Kansas total.....	20.1	2,490	24.3	735	25.2	520	26.5	463	28.4	365
Iowa	20.6	1,819	..	.....	....	.....	....	.....	....	.....
South Atlantic states.	15.8	179	21.8	110	20.7	96	25.0	78	39.3	8
North Atlantic states.	17.8	1,948	24.8	345	28.9	122	22.8	53	27.0	47
South Central states.	19.2	350	22.4	121	24.5	133	25.0	68	29.2	74
North Central states.	18.2	5,060	21.5	1,356	25.7	1,045	26.5	736	31.8	612
Western states	20.6	2,075	23.5	232	26.0	234	26.4	186	31.4	115
Grand total.....	19.2	13,921	22.9	2,899	25.6	2,150	26.5	1,584	29.7	1,221

the material read. Sometimes this second factor is called quality of reading. In the case of the Kansas Silent Reading Tests these two factors are combined in a single score. The values assigned to the exercises which make up these tests were made proportional to the average length of time required to do the several exercises correctly. Since the two factors are combined in this way, we have no expression of the relative weight of each in the value of the exercises.

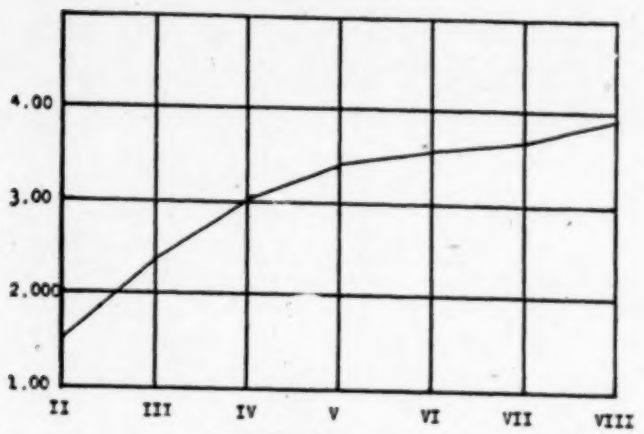


Figure 2.
Showing progress of pupils in rote and silent reading as measured by the Gray Silent Reading Tests.

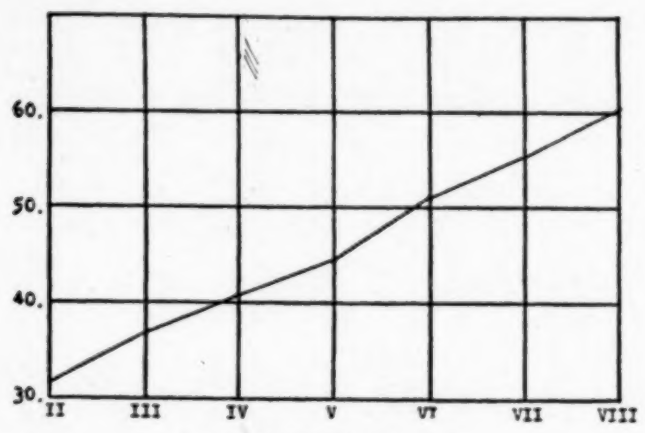


Figure 3.
Progress of pupils in quality of silent reading as measured by the Gray Silent Reading Tests.

In Figs. 2 and 3 are shown the curves of progress for rate of silent reading and for quality of silent reading as determined by means of the Gray Silent Reading Tests.[1] The curve of progress for the rate of silent reading, Fig. 2 rises rapidly for the earlier grades and less rapidly in the upper grades, with the partial exception of the eighth grade. This means that the pupil in learning to read increases his rate of silent reading most rapidly in grades 2, 3, and 4. In the following grades his increase is very slight. When we study the curve of progress for quality of silent reading in Fig. 3 we find that the pupil continues to increase the quality of his silent reading at about the same rate throughout the several grades represented. Apparently the pupils' improvement in silent reading in the upper grades is in quality rather

[1] GRAY, WILLIAM S., *Studies of Elementary School Reading from Standardized Tests*, pp. 53–54. Supplementary Educational Monographs, University of Chicago, No. 1, 1917.

than rate. This increase in quality in the case of the Gray Silent Reading Tests means that the pupils is able to comprehend more difficult passages as well as to comprehend them more fully.

If we compare these two curves of progress with the curve of progress for the Kansas Silent Reading Tests shown in Fig. I, we find the curves of progress for the Kansas Silent Reading Tests corresponds closely in shape to the curve of progress for quality of silent reading. This fact suggests that the scores made on the Kansas Silent Reading Tests are measures of the quality of silent reading rather than the rate of silent reading. No final conclusion should be drawn from the data presented in these three figures because the tests were not applied to the same group of pupils, but since both of the tests have been used rather widely, particularly the Kansas Silent Reading Tests, it probably is safe to think of the Kansas Silent Reading Tests as placing more emphasis upon comprehension or quality of silent reading than upon rate of silent reading.

It has frequently been asked, What is the effect upon a pupil's score of his acquaintance with the test? No definite study has been made to determine the answer to this question. It has been a rather important question because only one form of the Kansas Silent Reading Tests was available, and if a superintendent wished to know what improvement had been made in silent reading he was forced to repeat the same test.

It is probable that several factors will affect the second set of scores. If the tests have been made the subject of a study by the pupils, without doubt the scores will be much higher. Even if the pupils have been drilled upon the type of reading which these tests call for, doubtless the second set of scores will be much higher than the first set.

In Table II there are given two sets of scores for several cities in which the tests were given the second time and both sets of scores reported to the Bureau of Educational Measurements and Standards. A study of this table will show that in certain cases the scores of the second set are conspicuously higher than those of the first set. In certain other cases they are lower. The facts of this table suggest that the pupil's acquaintance with the tests, through merely having taken it, does not greatly influence a second score. Otherwise it would be difficult to understand how a second set of scores might be lower than the first set.

TABLE II.

Cities Giving the Tests Twice

City	Date	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
LXXV.....	11–15	3.1	7.3	12.4	12.1	13.5	18.2	22.7	25.1	20.0	30.0
LXXV.....	4–16	7.3	11.9	16.0	18.8	20.9	27.0	30.0	28.3	34.8	29.5
XXVII.....	4–16	3.5	7.4	12.9	11.7	16.3	18.4	....	....	....	....
XXVII.....	3–17	4.5	13.8	14.3	13.2	19.5	21.6	....	....	....	....
CLXVIII....	10–16	....	5.0	9.4	8.6	14.4	13.0	....	....	.. ..	....
CLXVIII....	4–17	...	9.7	17.6	11.1	20.1	18.0	....	....	....	....
VIII.....	5–16	4.4	8.0	13.0	14.0	16.8	26.3	....	....	....	....
VIII.....	2–17	5.9	7.5	13.7	13.7	15.0	19.1	....	....	....	....
XLV.....	1–16–17	6.0	9.5	14.6	16.0	18.8	22.1	....	....	....	....
XLV.....	1–23–17	....	....	....	15.0	17.8	19.5	....	....	....	....
LXXIII.....	5–16	2.9	7.8	12.5	11.7	14.6	13.0	....	....	....	....
LXXIII.....	1–17	2.5	6.7	10.9	10.7	12.8	14.7	....	....	....	....
CVIII.....	9–16	0.0	3.5	7.0	8.0	16.5	21.0	19.2	20.3	25.0	20.0
CVIII.....	1–17	....	....	....	....	....	....	18.0	25.0	33.3	40.0
CXXXI.....	9–16	.8	5.0	6.4	13.0	15.0	16.7	....	....	....	....
CXXXI.....	1–17	6.6	11.0	12.3	18.0	18.0	21.6	....	....	....	....

In Table III there are given the median scores for several adult groups to whom the tests were given. Generally these groups were teachers assembled in institute or students in education classes. These medians have no special significance aside from indicating the scores which may be expected of adults.

TABLE III.

Showing Median Scores for Adults

Test	Medians	Number tested
II.....	34.6	54
I.....	18.5	62
III.....	35.0	64
III.....	35.8	330
I.....	23.0	65
II.....	32.0	65
III.....	40.4	65
——.....	36.8	36
——.....	34.8	37

Numerous criticisms have been made of the Kansas Silent Reading Tests. A number of these are probably valid and significant. Only a few of the criticisms reported to the Bureau of Educational Measurements and Standards have had to do

with insignificant details. The most frequent criticism has been concerning the character of the exercises. It has been pointed out that the exercises partake of the nature of puzzles, a very large number of them being arithmetical in nature. For this reason they are not typical reading material. This criticism is obvious to any one who examines the tests, and was very obvious to the author of the tests before they were published for distribution. The author attempted to eliminate this defect of the tests, but it was found impossible at that time. Granted that this criticism is valid, it remains to determine just how much it limits the significance of the scores obtained.

The above characteristic of the test was due largely to the fact that an effort was made to have the tests objective; that is, to have them of such a nature that a minimum of opinion would be exercised in marking the papers. This is a feature which is very important and which is not true of most of the reading tests which have been devised. The question might well be raised whether or not it was worth while to sacrifice other things to obtain this feature.

It has also been said that the ability measured by these tests was the ability to reason rather than to read; that in ordinary reading the mental processes involved were not those of reasoning, hence the scores obtained by means of these tests had no particular significance with reference to reading. The significance of this criticism of course depends upon what reading is. Certainly the exercises of these tests do have to do with the ability which occurs in some reading. It is probably true that a more satisfactory test could be devised by securing exercises which are more nearly like the ordinary reading material which the child meets in the elementary school.

A number who have used the tests have taken occasion to say that they found the tests very easy to administer and requiring only a small amount of time. In fact, no one has reported any difficulty in using the tests, or has even asked questions about giving them. This fact is significant, because teachers can not be expected to use tests which they do not understand or which require an unusual expenditure of time.

AN ANNOTATED BIBLIOGRAPHY OF RECENT LITERATURE ON THE BINET-SIMON SCALE (1913-1917)

PART IV

SAMUEL C. KOHS

Research Fellow under the Buckel Foundation, Leland Stanford Jr. University

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"Almost everything that has been written about the Binet scale (until very recently) has been in the nature of praise—both judicious and extravagant, rather more of the latter. I think it is worth while, therefore, to call attention to some of the current misconceptions, and to sound a few warning notes, regarding psychological examinations."

412. WALLIN, J. E. W.: *The Mental Health of the School Child.*
New Haven: Yale Univ. Press, 1914, 463 pp.

413. WALLIN, J. E. W.: *The Hygiene of Eugenic Generation.*
Psychol. Clinic, 1914, 8: 121–137, 170–179.
Adversely criticizes studies in heredity based upon the reports of field-workers who used the scale for detecting feeble-mindedness. Cites cases indicating scale reactions.

414. WALLIN, J. E. W.: *An Analysis of Dr. Kuhlmann's Attack on "The Mental Health of the School Child."*
J. Psycho-Asthen., 1914, 19: 95–107.
A reply to Kuhlmann's criticisms. (See earlier reference.)

415. WALLIN, J. E. W.: *The Binet-Simon Tests in Relation to the Factors of Experience and Maturity.*
Psychol. Clinic., 1915, 8: 266–271.
Reviews some of the material in his "Experimental Studies of Mental Defectives" relating to these problems and indicates that native ability cannot be measured unmodified by environmental influences.

416. WALLIN, J. E. W.: *Psycho-educational Clinic and Special Schools.*
Sixty-first Annual report, pages 130–160, Bd. of Educ. of the City of St. Louis, Mo., 1915, 698 pp.
Of 430 cases recommended to the clinic for examination, 25.9% of the 320 boys and 40% of the 110 girls were found feeble-minded. There were almost twice as many backward and retarded as feeble-minded.

417. WALLIN, J. E. W.: *Who Is Feeble-minded?*
J. Crim. Law and Criminol., 1915–16 6: 706–716. Also,
Ungraded, 1916, 1: 105–113.
Based on the evidence presented by a number of definitely normal persons, it is maintained that adult individuals testing above ten years are unjustifiably called feeble-minded. (For reply to this article, see earlier reference.)

418. WALLIN, J. E. W.: *"Who Is Feeble-minded?" A Rebuttal.*
J. Crim. Law and Criminol., 1916, 7: 222–226.
A reply to article by Kohs. (See earlier reference.)

419. WALLIN, J. E. W.: *Criminal Irresponsibility.*
J. of Delinq., 1916, 1: 250–255.
"While we are in sympathy with the view that feeble-minded criminals should be treated as feeble-minded irresponsibles, we have not found it possible to accept the expanded interpretation which has been given the concept of feeble-mindedness." Namely, considering persons feeble-minded who yield a Binet scale reaction of 10, 11, or 12 years.

420. WALLIN, J. E. W.: *The Socio-Industrial Success of Feeble-minded Children Trained in Public Schools.*
Ungraded, 1916, 1: 142–143.
On the basis of 10, 11, or 12 year intelligence children should not be placed in special classes.

421. WALLIN, J. E. W.: *Mentality Tests: A Symposium.* (See earlier reference.)
J. Educ. Psychol., 1916, 7: 353–357.
"The Binet scale has fallen into considerable disrepute," not so much due to inherent defects of the scale, as to unfounded claims made for it, as well as its misuse by persons not properly qualified. During the period of mental growth the points of the point scale must be translated in terms of chronological age in order to be significant. *Norms* of performance should be based on the reactions of *normal* children only. Unselected groups inevitably include both normal and abnormal types. Makes the plea for tests and norms of psycho-motor capacity. Advises the endowment of a station for psychological tests and standards.

422. WALSH, ELIZABETH A.: *Ungraded Class Work in New York City—Methods and Results.*
J. Psycho-Asthen., 1914, 19: 59–66.
The use of the tests as an aid to class-room management.

423. WEIDENSALL, JEAN: *The Mentality of the Criminal Woman.*
Baltimore: Warwick and York, 1916, 332 pp.
The use of the scale in a comparative study of reformatory and working women.

424. WEIDENSALL, JEAN: *Criminology and Delinquency.*
Psychol. Bull., 1913, 10: 229–237.
Indicates tendency of conservatism in advising general use of the scale.

425. WENDER, LOUIS: *The Applicability of Binet-Simon Intelligence Tests in Psychoses of the Senium.*
N. Y. Med. J., Vol. CI, Mar. 6, 1915.
Intelligence and senility.

426. WHIPPLE, G. M.: *Stern, L. William: The Psychological Methods of Testing Intelligence.* (Educ. psychol. mon., no. 13.)
Baltimore: Warwick & York, 1914, 160 p.

427. WHIPPLE, G. M.: *The Use of Mental Tests in the School.*
5th Yrbk. Nat. Soc. for the Study of Educ., Part I, 1916, pp. 149–160.
A general summary indicating the great benefits for the educational system which makes use of the scale. A number of valuable suggestions.

428. WHIPPLE, G. M.: *Mentality Testing: A Symposium.* (See earlier reference.)
J. Educ. Psychol., 1916, 7: 357–360.
"The great need of the tester is that he shall come to 'feel' the conditions under which testing is reliable almost intuitively." Does not believe a standardizing bureau practicable. "The best methods will emerge on their own merits" because capable of "delivering the goods." Mentions need of scale to measure intellectual level of adolescents and outlines a method for use with college entrants. Points out neglect of tests "for the intensive and rather precise analysis" of specific abilities (psychogram).

429. WHITMAN, JOHN L.: *Jails, Lockups and Police Stations.*
J. Crim. Law and Criminol., 1915–6, 6: 240–248.

Outline of a program for a psychological research laboratory in a centralized system for unconvicted offenders.

430. WIERSMA, E. D.: *Intelligenzprüfungen nach Binet und Simon und ein Versuch zur Auffindung neuer Tests.*
Zsch. f. angew. Psychol., 1913–14, 8: 267–275.
Used the Binet-Bobertag 1911 revision, testing 141 Volkschule children, ages 6 to 12. Makes an analysis of his findings and suggests some new tests: concentration of attention, word building, dissected pictures, and picture recognition.

431. WILLIAMS, J. HAROLD: *The Problem of the Delinquent Boy.*
Child, 1915, 6: 29–32.
Examined 215 delinquent boys by means of the Stanford Revision of the scale. Found 32% feeble-minded.

432. WILLIAMS, J. H.: *Backward and Feeble-minded Children in Salt Lake City.*
Trg. School Bull., 1915, 12: 123–129.
A study of 108 backward school children. Estimates number of feeble-minded children in the schools at nearly 600. A few cases studies with Binet reactions.

433. WILLIAMS, J. H.: *Intelligence and Delinquency.*
J. Crim. Law and Criminol., 1915–16, 6: 696–705.
Preliminary report on the Whittier findings. (See later reference.)

434. WILLIAMS, J. H.: *Defective, Delinquent and Dependent Boys.*
Whittier State School (Cal.) Dept. of Research, Bull. 1, Dec., 1915, 16 pp.
The results obtained through the use of the scale discussed.

435. WILLIAMS, J. H.: *Classification of Fifty Backward and Feeble-minded School Children.*
Psychol. Clinic., 1915, 9: 97–106.
Application of the Stanford revision to selected children in four California cities. 32% were feeble-minded, 20% borderline, 22% dull normal, and 26% normal or superior.

436. WILLIAMS, J. H.: *A Study of 150 Delinquent Boys.*
Research Lab. of the Buckel Foundation, Stanford Univ., Bull. No. 1, 1915. 15 pp.

437. WILLIAMS, J. H.: *Delinquent Boys of Superior Intelligence.*
J. of Delinq., 1916, 1: 33–52.
A study of 20 delinquent boys possessing intelligences above the average for their ages (6½% of the total delinquent population in the Whittier State School). Individual cases discussed.

438. WILLIAMS, J. H., AND TERMAN, L. M.: *Psychological Survey of the Whittier State School* (47 pp.)
Bound in Biennial Report, Whittier State School, Whittier, Cal.: State School, 1914.
The findings based upon a mental examination of 150 inmates interpreted in the light of necessary changes in the administration of the school.

439. WINCH, W. H.: *Binet's Mental Tests. What They Are, and What We Can Do with Them.*
Child Study, 1914, 7: 1–5, 19–20, 39–45, 55–62. 87–90, 98–104, 116–122, 138–144. 1915, 8: 1–8, 21–27, 50–56, 86–92, (to be continued).
See reference 252 in earlier bibliography.

440. WINCH, W. H.: *The Detection on a Large Scale of Mental Deficiency in School Children.*

In Conference Report, National Assoc. for the Feeble-minded, London, June 25, 1915.

441. WITMER, LIGHTNER: *Congenital Aphasia and Feeble-mindedness—A Clinical Diagnosis.*

Psychol. Clinic, 1916, 10: 181–191.

The value and accuracy of the scale discussed.

442. WITMER, L.: *C. ical Records.*

Psychol. Clinic., 1915, 9: 1–17.

The qualitative evidence of a Binet examination is of far more significance than the quantitative. Since experienced examiners can pick out the feeble-minded on sight, why use the scale at all?

443. WITMER, L.: *The Relation of Intelligence to Efficiency.*

Psychol. Clinic, 1915, 9: 61–86.

Mental age "gives no clue as to the grade of a child's intelligence, although an experienced observer may estimate it from his behavior in solving some of the tests." The scale does not measure intelligence development. General intelligence cannot be tested. For the "differential diagnosis of intelligence" Witmer mentions twelve performance scales.

444. WOOLLEY, HELEN T.: *The Psychology of Sex.*

Psychol. Bull., 1914, 11: 353–379.

Reviews studies in general intelligence, measured by the scale, which throw light upon sex differences.

445. WOOLLEY, HELEN T.: *A New Scale of Mental and Physical Measurements for Adolescents, and Some of Its Uses.*

J. Educ. Psychol., 1915, 6: 521–550.

Presents scale for fourteen and fifteen year-olds.

446. WOOLLEY, HELEN T.: *Further Suggestions Regarding Mentality Tests.* (See earlier reference.)

J. Educ. Psychol., 1916, 7: 431–433.

Explains the work now being done at the Bureau of Vocational Guidance, Cincinnati, and indicates the value of test standardization for the construction of scales to measure both specific and general ability.

447. WOOLLEY, H. T.: *The Mind of a Boy.*

Survey, 1916, 37: 122-125.

Applied point scale to 18 year-old industrial workers. 25.5% were found feeble-minded. Advises change in the definition of feeble-mindedness, so that the tests should yield a proportion of mental deficiency more in harmony with the common sense opinion of legislators.

448. WOOLLEY, HELEN T., AND FISCHER, CHARLOTTE R.: *Mental and Physical Measurements of Working Children.*

Psychol. Monogr., 1914, 18, No. 1.

Pessimistic regarding tests beyond age 12.

449. YERKES, ROBERT M., AND BRIDGES, J. W.: *The Point Scale: A New Method for Measuring Mental Capacity.*

Boston Med. and Surg. J., 1914, 171: 857–66.

This scale is suggested "to take the place of the Binet measuring scale of intelligence and to furnish a more definite and accurate index of the mental capacity of individuals that can be obtained by the employment of the Binet method."

450. YERKES, R. M.; BRIDGES, JAMES W.; AND HARDWICK, ROSE S.: *A Point Scale for Measuring Mental Ability.*
Baltimore: Warwick & York, 1915, 218 pp.
Detailed procedure and general directions given, as well as basis for standardization.

451. YERKES, R. M., AND ANDERSON, HELEN M.: *The Importance of Social Status as Indicated by the Results of the Point-Scale Method of Measuring Mental Capacity.*
J. Educ. Psychol., 1915, 6: 137–150.
Explanation of the point-scale. Finds a correlation between differences of social status and mental capacity.

452. YERKES, R. M.: *The Point Scale Method of Measuring Mental Ability.* (Paper read before Amer. Psychol. Assoc., 1914.)
Abstracted in Psychol. Bull., 1915, 12: 69.
Indicates the limitations of the Binet scale and the improvements made in the Point Scale.

453. YERKES, R. M.: *Educational and Psychological Aspects of Racial Well-Being.*
J. of Proc. and Address. of the 54th meeting of the Nat. Educ. Assoc., New York, 1916, p. 248. Also,
J. of Delinq., 1916, 1: 243–249.
"The so-called 'testing' of school children, now the fashion is a poor substitute for the kind of individual study that is needed. We must not imagine that the child is easily analyzed, measured, described. Only experts, highly trained, experienced in their special tasks, wise, are fit for the work. Incompetence is rife in the mental examining of school children, today, and unless harm is to result where good is experienced we shall have to look sharply to our methods and to the quality of our examiners." (Discussion by Helen C. Putnam.)

454. YERKES, R. M.: *Mental Examination of Police and Court Cases.*
J. Crim. Law and Criminol., 1916, 7: 366–372.
Cautions to be observed in diagnosis and treatment. Indicates what the examination ought to include.

455. YERKES, R. M.: *Mentality Tests: A Symposium.* (Letter quoted in discussion by C. E. Seashore. See earlier reference.)
J. Educ. Psychol., 1916, 7: 163–164.
"Age arrangement of tests is wrong in principle, violating the laws of mental development." Needs: three scales for measuring intelligence, supplemented by scales measuring mental functions. Announces the preparation of an adolescent-adult point scale for the measurement of intelligence. Advises ignoring the Binet method. Announces preparation of a book on "Psychological Examinations and Examiners: A Critique."

456. YERKES, R. M., AND WOOD, LOUISE. *Methods of Expressing Results of Measurements of Intelligence: Coefficient of Intelligence.*
J. Educ. Psychol., 1916, 7: 593–606.

An argument to prove the superiority of the coefficient of intelligence as an index of intellectual development.

457. YOUNG, M.: *The Mentally Defective Child.*
H. K. Lewis & Co., 1916, 140 pp.
One of the topics treated is the scale.

THE END

THE DERIVATION OF SIMPLER FORMS OF REGRESSION EQUATIONS

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As stated by Kelley on page 7 of his valuable bulletin on partial correlation and regression equations,[1] "The peculiar value of the regression equation is twofold: (1) It gives the mathematical means of combining any number of measures into a single measure in such a way that the highest possible correlation with a dependent measure is obtained. . . . (2) Further, the regression equation makes possible an analysis of the relative importance of the various contributory factors which bear upon a final result." (It is realized, of course, that by the latter statement is meant that the *most probable* relation of the importance of the various factors may be found. Except in rare instances, the possibility of the occurrence of which is theoretical, no absolutely true relations are found by regression equations.) Before the appearance of Kelley's *Tables* the labor involved in the solution of regression equations of more than three or four variables was almost prohibitive. It is estimated, however, that the *Tables* reduce the work eighty percent. It will be shown, moreover, that the equations may also be simplified. Thus, on page 8 of the bulletin is given the equation:

$$x_1 = b_{12\cdot3}x_2 + b_{13\cdot2}x_3 \tag{1}$$

(x being the dependent variable.) Now an equation giving only the ratio of the coefficients of x_2 and x_3 is sufficient to serve the purposes mentioned above, provided accurate measures of the probable errors of the coefficients are not required, and is easier to solve.

Such an equation would be in the form:

$$\frac{x_1}{c} = \frac{b_{12\cdot3}}{b_{13\cdot2}}x_2 + x_3 \tag{2}$$

Now

$$x_1 = r_{12\cdot3}\frac{\sigma_{1\cdot23}}{\sigma_{2\cdot13}}x_2 + r_{13\cdot2}\frac{\sigma_{1\cdot23}}{\sigma_{3\cdot12}}x_3 \tag{3}$$

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[1] TRUMAN L. KELLEY, *Tables: To Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations.* Bulletin of the Univ. of Texas, 1916, No. 27. (See review.)

Dividing by the coefficient of x_3, which let us call C_{x_3}

$$(4)\quad \frac{x_1}{c_{x_3}} = \frac{r_{12\cdot 3}}{r_{13\cdot 2}}\frac{\sigma_{3\cdot 21}}{\sigma_{2\cdot 31}}x_2 + x^2$$

$$(5)\quad = \frac{r_{12}-r_{13}r_{23}}{r_{13}-r_{12}r_{23}}\frac{\sqrt{1-r^2_{12}}\sqrt{1-r^2_{23}}}{\sqrt{1-r^2_{13}}\sqrt{1-r^2_{23}}}\frac{\sigma_3\sqrt{1-r^2_{13}}\sqrt{1-r^2_{23\cdot 1}}}{\sigma_2\sqrt{1-r^2_{12}}\sqrt{1-r^2_{23\cdot 1}}}x_2 + x_3$$

$$(6)\quad \frac{x_1}{c_{x_3}} = \frac{r_{12}-r_{13}r_{23}}{r_{13}-r_{12}r_{23}}\frac{\sigma_3}{\sigma_2}x_2 + x_3$$

Thus it may be seen that it is possible to find the relative values of the coefficients of x_2 and x_3 without finding any coefficients of partial correlation. The number of arithmetic operations involved in the solution is reduced from 14 to 7.

It may be of interest here to note that the coefficient of x_2 in equation 6 is identical with the value of the weight, w, which will make the value of $r_{x_1(wx_2+x_3)}$ a maximum, as found by calculus. Thus by the formula for the correlation of one variable with the sum of a number of others (see "formula a," p. 19 of the *Tables*),

$$r_{x_1(wx_2+x_3)} = \frac{wr_{12}\sigma_1\sigma_2 + r_{13}\sigma_1\sigma_3}{\sqrt{w^2\sigma_2^2+\sigma_3^2+2wr_{23}\sigma_2\sigma_3}}$$

Differentiating the right-hand member with respect to w, placing the differential equal to zero, and solving gives

$$w = \frac{r_{12}-r_{13}r_{23}}{r_{13}-r_{12}r_{23}}\frac{\sigma_3}{\sigma_2}$$

which may be seen to be the same as the coefficient of x_2 in equation 6.

Similarly it may be shown that the regression equation for four variables may be reduced as follows:

$$(7)\quad x_1 = r_{12\cdot 24}\frac{\sigma_{1\cdot 234}}{\sigma_{2\ 134}}x_2 + r_{13\cdot 24}\frac{\sigma_{1\cdot 234}}{\sigma_{3\cdot 124}}x_3 + r_{14\cdot 23}\frac{\sigma_{1\cdot 234}}{\sigma_{4\ 123}}x_4$$

$$(8)\quad \frac{x_1}{c_{x_4}} = \frac{r_{12\cdot 34}}{r_{14\ 23}}\frac{\sigma_{4\cdot 123}}{\sigma_{2\cdot 134}}x_2 + \frac{r_{13\cdot 24}}{r_{14\cdot 23}}\frac{\sigma_{4\cdot 123}}{\sigma_{3\cdot 124}}x_3 + x_4$$

$$(9)\quad \frac{x_1}{c_{x_4}} = \frac{r_{12.3}-r_{14.3}r_{24.3}}{r_{14.3}-r_{12.3}r_{24.3}}\frac{\sigma_4\sqrt{1-r^2_{34}}}{\sigma_2\sqrt{1-r^2_{23}}}x_2 + \frac{r_{13.2}-r_{1.42}r_{34.2}}{r_{1.42}-r_{1.23}r_{34.2}}\frac{\sigma_4\sqrt{1-r^2_{24}}}{\sigma_3\sqrt{1-r^2_{23}}}x_3 + x_4$$

By this form of the equation the number of coefficients of partial correlation necessary to be found is reduced from 12 to 6, while the number of arithmetical operations remains the same, 18.

Similarly, again, it may be shown that the regression equation for five variables may be altered to read:

$$(10)\qquad \frac{x_1}{c_{x_5}} = \frac{r_{12.34}-r_{15.34}r_{25.34}}{r_{15.34}-r_{12.34}r_{25.34}}\,\frac{\sigma_5\sqrt{1-r^2_{45}}\,\sqrt{1-r^2_{35.4}}}{\sigma_2\sqrt{1-r^2_{24}}\,\sqrt{1-r^2_{23.4}}}\,x_2 +$$

$$\frac{r_{13.24}-r_{15.24}r_{35.24}}{r_{15.24}-r_{13.24}r_{35.24}}\,\frac{\sigma_5\sqrt{1-r^2_{45}}\,\sqrt{1-r^2_{25.4}}}{\sigma_3\sqrt{1-r^2_{34}}\,\sqrt{1-r^2_{23.4}}}\,x_3 +$$

$$\frac{r_{14.23}-r_{15.23}r_{45.23}}{r_{15.23}-r_{14.23}r_{45.23}}\,\frac{\sigma_5\sqrt{1-r^2_{35}}\,\sqrt{1-r^2_{25.3}}}{\sigma_4\sqrt{1-r^2_{34}}\,\sqrt{1-r^2_{24.3}}}\,x_4 + x_5$$

By this form of the equation the number of coefficients of partial correlation necessary to be found is reduced from 32 to 21, but the number of necessary arithmetical operations increases from 28 to 33. In as much, however, as the finding of each coefficient of partial correlation requires a consultation of the tables and two arithmetical operations, the work of solving a regression equation of five variables is considerably reduced. It appears, however, that the relative amount of saving diminishes as the number of variable increases.

As an illustration of the use of a simplified regression equation we will show the solution of the equation involving four variables using the same coefficients of correlation which Kelley used in the illustration on page 12. The coefficients of partial correlation of the first order would be found in the usual manner, therefore we may use the values he has found. Substituting these and the values of sigma in equation 7 above,

$$\frac{x_1}{c_{x_4}} = \frac{.137-.191\times(-.199)}{.191-.137\times(-.199)}\,\frac{4.64}{3.13}\,\frac{.842}{.777}\,x_2 +$$

$$\frac{.032-.207\times.537}{.207-.032\times.537}\,\frac{4.64}{6.12}\,\frac{.978}{.777}\,x_3 + x_4 = 1.29x_2 - .400x_3 + x_4$$

Multiplying these coefficients by 5 instead of by 17.3 (both arbitrary) gives the same weightings, 6.5, –2, and 5, as Kelley found, for the three tests. The weightings, 8, 4, 2, and 1, given on page 17 can be found in the same way, using equation 10.

ABSTRACTS AND REVIEWS

TRUMAN LEE KELLEY. *Tables; To Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations.* Bulletin of the University of Texas, May 10, 1916, No. 27.

The general purpose of these tables is clearly indicated in the title. One of the rather tedious formulas to be solved in connection with the calculation of partial coefficients is that of the form:

$$r_{12\cdot3} = \frac{r_{12} - r_{13}\cdot r_{23}}{\sqrt{(1-r^2_{13})\,(1-r^2_{23})}}$$

(See G. Udny Yule, Intro. to the Theory of Statistics, p. 235, new edition p. 239.) Two such equations must be solved even in the simplest case of three variables. The fraction in the equation can be divided so that

$$r_{12\cdot3} = r_{12}\left(\frac{1}{\sqrt{(1-r^2_{13})\,(1-r^2_{23})}}\right) - \left(\frac{r_{13}\cdot r_{23}}{\sqrt{(1-r^2_{13})\,(1-r^2_{23})}}\right)$$

Kelley puts A and B in place of these parentheses, letting

$$r_{12\cdot3} = r_{12}A_{13,23} - B_{13,23}$$

$A_{13,23}$ and $B_{13,23}$ are therefore seen to be functions of r_{13} and r_{23}. The chief table given in the bulletin is that giving the values of A and B for all values of r_{13} and r_{23} to two decimal places. Other pertinent tables are also given.

The great convenience afforded by these tables in the calculation of partial coefficients of correlation will no doubt be more widely appreciated as the technique of such calculation becomes more extensively used. However, such technique is as yet probably unfamiliar to a large proportion of persons who have found a need for correlational mathematics, but who have not had much mathematical training. For this reason it is believed that in a second edition one or two examples of the simplest case of three variables should be worked out quite fully and applications shown. If necessary the case of five variables might be omitted, except to give the formula. The derivation of the values of A and B from the customary formula, as given above, would seem quite naturally to belong in the discussion. On the whole, the tables furnish a valuable contribution to the present group of mathematical appliances.

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EDITORIAL

THE LEAVEN IS WORKING

The steady growth and extension of the scientific attitude toward the solution of educational problems should be most gratifying to all who are interested in the field which this journal represents. More and more frequently one finds evidences of this attitude in the discussions of educational gatherings, in the articles that appear in the non-technical educational journals, in the reports of school superintendents, and in the printed courses of study. Educational workers are rapidly developing a keen sensitiveness to the differences between fact and opinion and a readiness to discount opinion which is not backed up by factual evidence.

Perhaps the most striking change which the scientific attitude is bringing about is the development of a more rational attitude toward educational panaceas and cure-alls. The improbability that all of the problems of a complicated art can be solved by the application of a blanket dogma such as "interest," "mental discipline," "self activity," the "formal steps," "motivation," "correlation," and the

like, is readily recognized by one who has been trained to look facts in the face. And at the same time, there is a tolerant attitude toward innovations—a willingness to grant the possible virtues of this or that proposal, always subject to the verdict of controlled test. The scientific educator is usually ready to try almost anything once. There is less "cocksureness" than there was a decade ago, even among educational psychologists and statisticians. There is less "scolding" of teachers and school officers for their failure to know and act upon something that was discovered only the day before yesterday. The new blade has been tempered; it cuts far more keenly than it did before, but those who use it are much more careful not to spoil its edge.

A PROGRAM NEEDED

There will be a vital need for this scientific attitude in the period of reconstruction that will immediately follow the war. There can be no reasonable doubt that reconstruction throughout the world will center in education. Both England and France have already projected plans for educational reform involving changes that would have been deemed utopian in 1914, while from Germany there come persistent rumors of a transformation of educational ideals that may be even more sweeping in its scope and consequences. Certainly if the war has proved anything it has proved that, under modern conditions, the strength of nations varies directly witü the attention that they give to universal education.

All of this means that educational reform will be the focus of constructive efforts to build up a new world order, and the scientific attitude and the scientific temper must guide and control these efforts if the largest permanent good is to be accomplished. It is none too early to prepare for this period of reconstruction. The amateur educational statesman will be ready with his nostrums; but those who have studied educational problems long and seriously should have something much more fundamental and thoroughgoing—a penetrating program, the virtues of which as compared with the snap-shot superficialities of the amateur will be apparent at once to the public.

W. C. B.

NOTES AND NEWS

The twenty-sixth annual meeting of the American Psychological Association was held in affiliation with the American Association for the Advancement of Science at Pittsburgh, December 27–29. Among the papers on the program the following were of interest to educational psychologists: "The Forgetting Curve as Affected by Conditions of Learning," E. C. Tolman; "The Mentality of Oriental and American College Students," K. T. Waugh; "Norms of Irregularity on Point and Stanford Scales," S. L. Pressey; "The Stanford Revision as Applied to College Students," H. H. Caldwell; "Substitution and Direction Tests Correlated with Class Standing," R. H. Gault; "The Use of Mental Tests in Selecting Pupils for a Gifted Class," G. M. Whipple; "A Standardized Opposites Scale," E. E. Jones; "Elements in Reading Abilities," D. Starch; "Determinants of Error in Spelling," L. S. Hollingworth; "The Learning Curves of the Analogies, Mirror Reading, and Alphabet Tests," F. A. C. Perrin; "Objective Measurement of Relative Size of Units in a Judgment Scale," S. A. Courtis; "Spelling Ability and Vocabularies of 200 College Students," E. Murray. The presidential address by Major Robert M. Yerkes was on the topic "Psychology in Relation to the War."

The program of the seventeenth meeting of the Central Association of Science and Mathematics Teachers, held at Columbus, Ohio, November 30 and December 1, contained papers of interest to scientific students of education, as follows: "The Present State of General Science as to Content and Method," Fred D. Barber; "A Study of the Attainments of High School Pupils in First Year Chemistry," J. Carleton Bell; "Measurement of the Products of Teaching High School Mathematics," S. A. Courtis; "The Place of Demonstrations in the Physics Classroom," R. O. Austin; "Some Suggestions in Measuring Results in Physics Teaching," Franklin T. Jones.

At the meeting of the New York Branch of the American Psychological Association, November 26, 1917, the following papers were presented: "Psychological Examinations of College Freshmen," Edith Carothers; "Distribution of Time in Learning Vocabularies," Robert A. Cummins; "When Does the Baby Begin to Think," G. C. Myers; "A New Clinical Test for the Temperature Sense," E. L. Cornell; "A Psychological Test of Expertness in Marksmanship," A. I. Gates.

At the meeting of the Kansas History Teachers' Association, on November 8, 1917, Professor David Snedden, of Teachers College, Columbia University, spoke upon "Needed Readjustments in History Teaching," urging a radical reorganization of the history course. —*School and Society.*

Professor Bird T. Baldwin, director of the child welfare research station of the University of Iowa, has been appointed research lecturer to the colleges of the state for the current year. It is the duty of the research lecturer to deliver at each of the colleges of the state a lecture illustrating some phase of his own scientific investigations with the purpose of stimulating interest in and enthusiasm for graduate study and original investigation. Professor Baldwin's theme will be "What is a Normal Child?"

Dr. J. Mace Andress, head of the department of psychology and child study at the Boston Normal School, is giving a course of twenty lectures at the Tuckermann School on "The Study of the Learning Process, Habit, and the Higher Mental Processes in Education."

At Swarthmore College the work in psychology and education formerly conducted by Professor Bird T. Baldwin will be carried on jointly by Professor Charles Fisher, of the department of education, West Chester State Normal School, and Professor S. B. Davis, of the department of education of Ursinus College.

Mr. Arthur S. Otis, formerly of Leland Stanford University, more recently assistant psychologist at the Vineland Training School for Feeble-Minded, is now doing war work in the office of the surgeon general at Washington.

Dr. Josiah Morse, professor of philosophy and sociology at the University of South Carolina, has been granted leave of absence for the duration of the war to become director of the Red Cross work in South Carolina and field director of the work at Camp Jackson. —*School and Society.*

Dr. Thaddeus L. Bolton, who has been psychological clinician in the public school system of Hartford, Conn , for the past two years, has been appointed professor of psychology in Temple University, Philadelphia.

Dr. H. H. Meeker has been made head of the department of education of Marshall College, taking the place of Miss Anna Cummings, resigned.

H. G. Wheat, formerly superintendent of schools of Williamstown, W. Va., has been appointed head of the department of education of the Glenville Normal School.

H. W. Anderson, of Iowa City, Iowa, has been appointed director of research in the Omaha, Nebraska, public schools.

T. H. Garth, Ph. D. (Columbia), has been elected head of the department of education in West Texas State Normal College.

Carl Rosenow (Ph. D., Chicago, '17) and Jacob Kantor (Ph. D., Chicago, '17) have been appointed instructors in the department of psychology of the University of Chicago.

PUBLICATIONS RECEIVED

WILLIAM H. ELSON AND SARAH A. HASTE. *Elson's Spelling Book.* Chicago: B. D. Berry Company, 1917. Pp. ix, 282.

This speller is constructed on lines of recent scientific investigation. It rests on the following general principles, which every psychologist can accept: (1) that spelling has to do with the writing vocabulary rather than with the general or reading vocabulary; (2) that we write only words the meaning and use of which we know; (3) that only needed words should be taught and the more difficult of these should be repeated and stressed; (4) that minimum test lists should be established for the various grades. The words are carefully divided into lessons for each day, with review lessons at the end of the week. Each advance lesson consists of nine words, six new and three repeated from the grade below. The book is intended to be used from the third grade to the eighth inclusive. The material for each half year ends with a list for a semi-annual contest, and each year presents a minimum list based on Ayres' spelling scale. The entire Ayres scale is given in the appendix. This is the first spelling book to give adequate weight to recent studies of spelling, and as such deserves the careful attention of superintendents and teachers.

JANE FALES. *Dressmaking. A Manual for Schools and Colleges.* New York: Charles Scribner's Sons, 1917. Pp. xiii, 508.

There is a growing recognition of the fact that dressmaking, cooking, carpentry, and metal working may be even more educative than Latin, algebra, or logic. One handicap under which the more concrete subjects have suffered is the lack of adequate, scholarly and comprehensive text-books. They have been treated too exclusively from the narrow, utilitarian point of view, and broader educative values have been ignored. The present volume is a distinct step in the direction of remedying this defect. Part One sketches the historic development of costume, part two discusses the manufacture of textiles and textile economics, and part three presents the technical details of dressmaking. If any college professor imagines that this subject does not demand intelligence or does not contribute mental training, let him carefully peruse this book and honestly estimate how much effort he would have to put forth to satisfactorily complete the course there outlined. There is an extensive bibliography on the history of costume and on textiles, but one is struck by the limited number of references on dressmaking itself. Dressmakers have undoubtedly been more active with the needle than with the pen.

HENRY FAIRFIELD OSBORN. *The Origin and Evolution of Life.* New York: Charles Scribner's Sons, 1917. Pp. xxxi, 322. $3.00.

This is one of the most important of recent books for a general philosophy of life. Presenting as it does the ripe thought of one of the world's greatest experimental zoologists and paleontologists, it stimulates the imagination and opens new vistas to the serious reader who is trying to understand himself in relation to his environment. Taking for granted the main outlines of the doctrine of evolution, the author pushes the argument farther back and presses the inquiry into the causes of evolution. "The first half of the volume is devoted to what we know of the capture, storage, release, and reproduction of energy in its simplest and most elementary living phases; the second half is devoted to the evolution of matter and form in plants and animals, also interpreted largely in terms of energy and mechanics." In carrying out this plan the author sketches the probable conditions of earth, air and water before there were any manifestations of life, the various forms of physical energy derived from the sun, inorganic and primitive organic chemical processes, describes the evolution of bacteria, algae and higher plants, and contrasts plant evolution with animal evolution. Then follows an account of the evolution of protozoa, of metazoa, the story of the fossil invertebrates, and then in turn the development of the fishes, the amphibians, the reptiles, the birds, and the mammals. The evolution of man is reserved for more extended treatment in a subsequent volume. While there is necessarily frequent use of terms from the vocabulary of geology and zoology, the discussion is popular rather than technical in its nature, and is directed to the person of average education. The work is profusely illustrated with material drawn largely from the splendid collections of the American Museum of Natural History, of which the author is president, and there is a bibliography of fourteen pages. It is a contribution to the popularization of natural philosophy of which Americans may well be proud.

ELLEN SCHMIDT. *A Dramatic Reader. Book Three.* Chicago: B. D. Berry Company, 1916. Pp. ix, 239.

Among the good old stories that are dramatized in this little book are "The Blind Men and the Elephant," "Three Men of Gotham," "Snowhite," "Hercules, the Lion Killer," "Loki and the Gifts," "Cinderella," "The Brahmin and the Tiger," and "The Ugly Duckling." The dramatizations will add greatly to the zest with which these stories are interpreted by young pupils.

The World Book. Organized Knowledge in Story and Picture. Edited by M. V. O'Shea, Ellsworth D. Foster, and George H. Locke, assisted by one hundred and fifty distinguished scientists, educators, artists and leaders of thought in the United States and

Canada. Chicago: Hanson-Roach-Fowler Company, 1917. To be complete in eight volumes. Vol. I, A-Blight, pp. 768. Vol. II, Blindness-Crow, pp. 769–1648.

This is a unique undertaking "to select out of the world's knowledge all that is most interesting, illuminating and useful, and present it in an orderly manner so that it may be comprehended, enjoyed and utilized alike by young and old." The efforts of the editors have been crowned with remarkable success. Written in simple, untechnical language, and richly illustrated, the volumes appeal even to children of the lower grades, and are an invaluable resource to the high school pupil. The various phases of school work, as addition, arithmetic, algebra, astronomy, bookkeeping, botany, chemistry, receive several pages each and contain many useful suggestions for parents and teachers. Perhaps the geographical terms are treated most fully and interestingly of all. Abyssinia, for example, has almost four pages, with two groups of illustrations. There is an account of the physical features of the country, the people and their occupations, cities and communication, government, and history, with a study outline and a list of questions to fix the important facts that one should know about the country. Africa has thirteen pages with six excellent maps, Alaska fourteen pages, Alberta eleven pages, and so on. Another class of terms that receive brief but satisfactory treatment are the names of historical, political and literary personages. These range from Aeschylus to King Albert of the Belgians, and are dealt with in just such fashion as would satisfy the needs of the ordinary reader. All information about current topics has been brought up to date, and much attention is paid to the geographical, political and economic changes which have been or are likely to be brougnt about by the War of Nations. In brief it is no exaggeration to say that this work far surpasses anything else of the sort in attractiveness, usefulness, and recency of information.

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